Version control with Git and GitHub

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Slide download

`https://files.indicatrix.org/git.pdf`

What is version control?

- Track changes to your code
- Know *when* and *who* made changes to code
- Revert to old versions of your code
- Archive specific versions of your code (e.g. after publication)
- `git` is the most popular version control system, and it's free

`git` vs. GitHub

`git`

- Software that runs on your computer
- Used to manage your code locally
- Runs from the command line

GitHub

- Website for hosting software stored in `git`
- Allows collaboration with other on `git`-based projects
- Allows *public* or *private* code storage

`git` Concepts

- Repository: storage for code for a single project
- Commit: Set of changes to the code
- Branch: Version of the code you can try something in before finalizing it
- Tag: Pointer to a specific version of your code (e.g. for publication)
- Working tree: The copy of your code on your system, which you may have modified since the last commit

What should I put in version control?

- Yes
  - Code
  - Text-based documentation (TeX, Markdown, etc.)
- Maybe
  - Binary documents (Word, Excel, etc.)
- No
  - Large files (larger than a few MB)
  - Data files (shouldn’t be changing often)

Collaboration

- Don’t share your `git` repository with others via Dropbox, etc.
- Repository can become corrupted if modified simultaneously
- Instead, use a service like GitHub

Live demo

Download and unzip:

`https://files.indicatrix.org/git-demo.zip`

Open a terminal

- Mac: Open Terminal application, type `cd `, drag folder into terminal, press enter
- Windows: Right-click in folder, choose Git Bash Here
- Linux: Open a terminal, `cd ~/where/you/unzipped/folder`

`git` Setup

- `git config --global user.name "Your Name"`
- `git config --global user.email "Your Email"`
  - If you push to a public repository on GitHub, your email will be public
  - If that concerns you, skip setting email for now
  - Later, follow: How to keep your email private on GitHub

Creating a new `git` repository

- `git init`
- `git add README.txt demo.R`
  - Can use `git add` more than once
- `git commit -m "Commit message"`
  - Quotes are important!

Make some changes to the files, create new files, etc.

Seeing what’s changed since the last commit

- `git status`

```
On branch master
Changes not staged for commit:
  (use "git add/rm <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
    modified: README.txt
    deleted: demo.R

Untracked files:
  (use "git add <file>..." to include in what will be committed)
    demo2.R

no changes added to commit (use "git add" and/or "git commit -a")
```

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Modified

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  (use "git add <file>..." to include in what will be committed)
    demo2.R

no changes added to commit (use "git add" and/or "git commit -a")
```

Modified

Deleted

New

Committing your changes

- `git add` for modified or new files
- `git rm` for deleted files
- `git commit -m "commit message"` to commit

Getting rid of your changes before you commit

- `git restore filename` for a single file
  - `git checkout filename` in older versions of `git`
- NO UNDO

Getting rid of your changes before you commit

- `git restore filename` for a single file
  - `git checkout filename` in older versions of `git`
- NO UNDO
- `git stash` for your entire working tree (except new files)
- `git stash pop` to undo

Creating a branch

- `git switch -c branch-name`
    - `git checkout -b branch-name` on older versions of `git`

Working on a branch

- Change some files
- Commit them

Switching back to your main branch

- Main branch is `master`
- To get back to it: `git switch master`
  - `git checkout master` on old versions
- Commit or restore everything before switching branches
  - Any changes not committed or restored will be retained when switching branches

Merging changes from a branch into `master`

- `git merge branch-name`
- If files have changed in both branches, `git` will try to combine the changes
- Always check that results make sense after a merge
- If the merge process doesn't work: how to resolve a merge conflict

Tagging a commit

-
  ```
  git tag tag-name
  ```
- Make sure you have no uncommitted changes

Getting back to an old tag

- `git tag` to list tags
- `git checkout <tag-name>` to restore that tag
- Check for changes using `git status` beforehand
- This *does not* change the master branch

Getting back to an old commit

- `git log`

```
commit 64660da5ee23476e82b9c199bee6efdcb91d7969
Author: Matthew Wigginton Conway <matt@indicatrix.org>
Date: Sat Dec 28 13:43:13 2019 -0500

adjust convergence criteria to be less stringent.

commit 169a33d0860d4a7914663f01794b4af0b6e6a82d
Author: Matthew Wigginton Conway <matt@indicatrix.org>
Date: Wed Nov 27 15:21:52 2019 -0800

    don't import bayer by default, remove dep on linearmodels.
```

Getting back to an old commit

- `git log`

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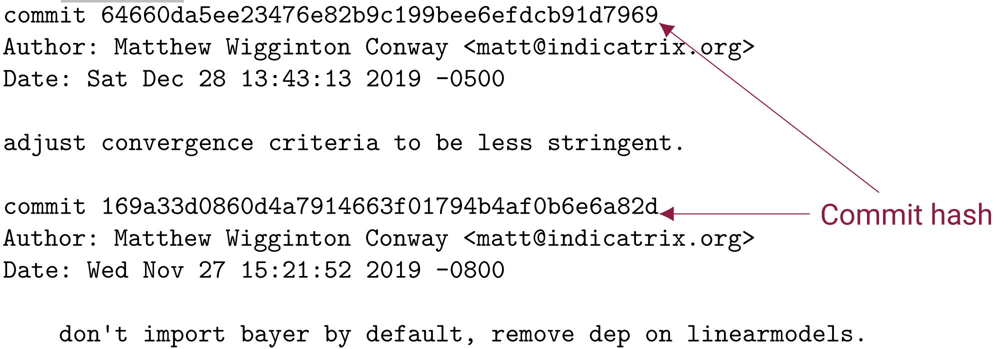
Commit hash

Getting back to an old commit

- `git log`



```
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    don't import bayer by default, remove dep on linearmodels.
```

Commit hash

- To go back to commit `169a33d`: `git checkout 169a33d`
- This *does not* change the master branch

Doing more work based on an old commit

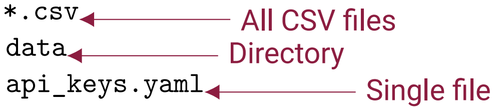
- Create new branch based on old commit or tag
- First, get to old tag or commit with `git checkout`
- Then, `git switch -c new-branch-name`
  - `git checkout -b new-branch-name` on old versions
- This creates a new branch that you can work on and commit to based on old version
- `git switch master` to get back to the most recent code
  - `git checkout master` on old versions
- Merging this branch could be messy

Getting a single file from an old commit or tag

- `git restore --source=<commit hash or tag> filename`
  - `git checkout <commit hash or tag> -- filename` on old versions
- `git add filename` then `git commit` to commit old version of file

What about files I don’t want to commit?

- Create a file `.gitignore` in your repository
- List any files or file patterns you don’t want to commit
- e.g.



```
*.csv
data
api_keys.yaml
```

All CSV files

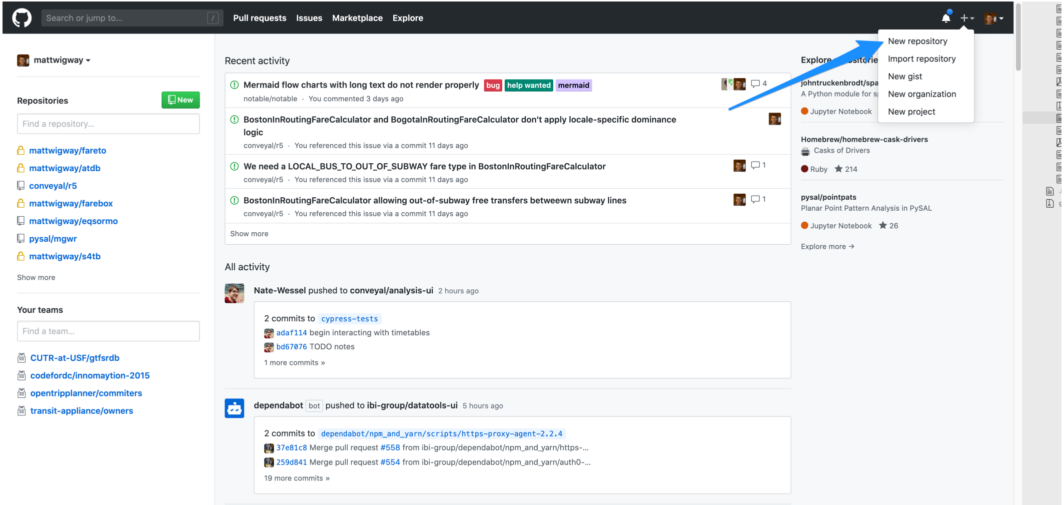
Directory

Single file

Pushing to GitHub

- You don’t have to use use GitHub to use `git`
- Repositories can be *public* or *private*
- In public repositories, all files and their history can be seen by anyone
  - Just deleting sensitive data before making a repository public doesn’t cut it...

Creating a repository



Search or jump to... /

Pull requests Issues Marketplace Explore

New repository
Import repository
New gist
New organization
New project

mattwigway

Repositories New

Find a repository...

- mattwigway/fareto
- mattwigway/atdb
- conveyal/r5
- mattwigway/farebox
- mattwigway/eqsormo
- pysal/mgwr
- mattwigway/s4tb

Show more

Your teams

Find a team...

- CUTR-at-USF/gtfsrdb
- codefordc/innomaytion-2015
- opentripplanner/commiters
- transit-appliance/owners

Recent activity

Mermaid flow charts with long text do not render properly bug help wanted mermaid 4
notable/notable · You commented 3 days ago

BostonInRoutingFareCalculator and BogotaInRoutingFareCalculator don't apply locale-specific dominance logic
conveyal/r5 · You referenced this issue via a commit 11 days ago

We need a LOCAL_BUS_TO_OUT_OF_SUBWAY fare type in BostonInRoutingFareCalculator 1
conveyal/r5 · You referenced this issue via a commit 11 days ago

BostonInRoutingFareCalculator allowing out-of-subway free transfers betweewn subway lines 1
conveyal/r5 · You referenced this issue via a commit 11 days ago

Show more

All activity

Nate-Wessel pushed to conveyal/analysis-ui 2 hours ago

2 commits to `cypress-tests`
`adaf114` begin interacting with timetables
`bd67076` TODO notes
1 more commits »

dependabot bot pushed to ibi-group/datatools-ui 5 hours ago

2 commits to `dependabot/npm_and_yarn/scripts/https-proxy-agent-2.2.4`
`37e81c8` Merge pull request #558 from ibi-group/dependabot/npm_and_yarn/https-...
`259d841` Merge pull request #554 from ibi-group/dependabot/npm_and_yarn/auth0-...
19 more commits »

Explore r ositorie

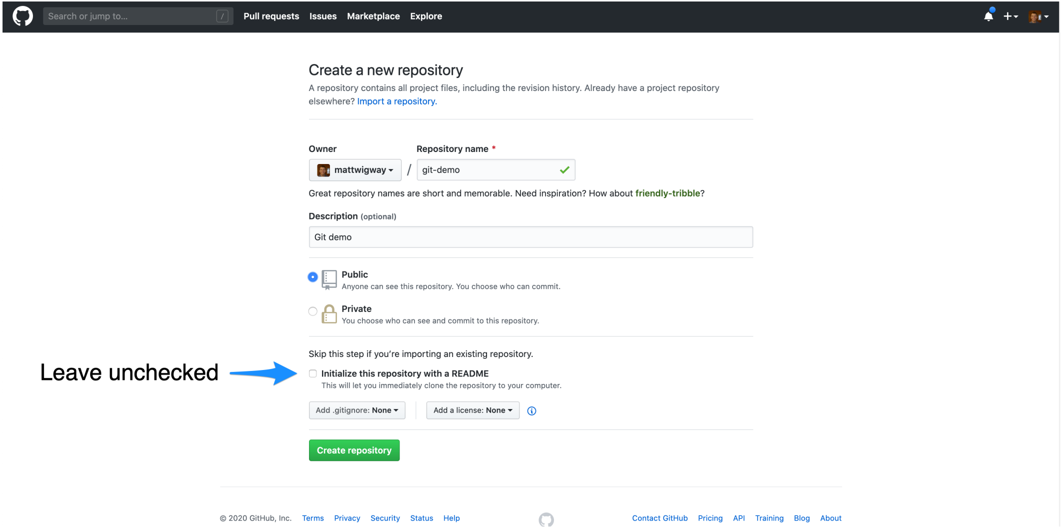
johntruckenbrodt/spa
A Python module for s
● Jupyter Notebook

Homebrew/homebrew-cask-drivers
Casks of Drivers
● Ruby ★ 214

pysal/pointpats
Planar Point Pattern Analysis in PySAL
● Jupyter Notebook ★ 26

Explore more →

Creating a repository



Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

Owner: mattwigway / Repository name *: git-demo ✓

Great repository names are short and memorable. Need inspiration? How about **friendly-tribble**?

Description (optional): Git demo

● **Public**
Anyone can see this repository. You choose who can commit.

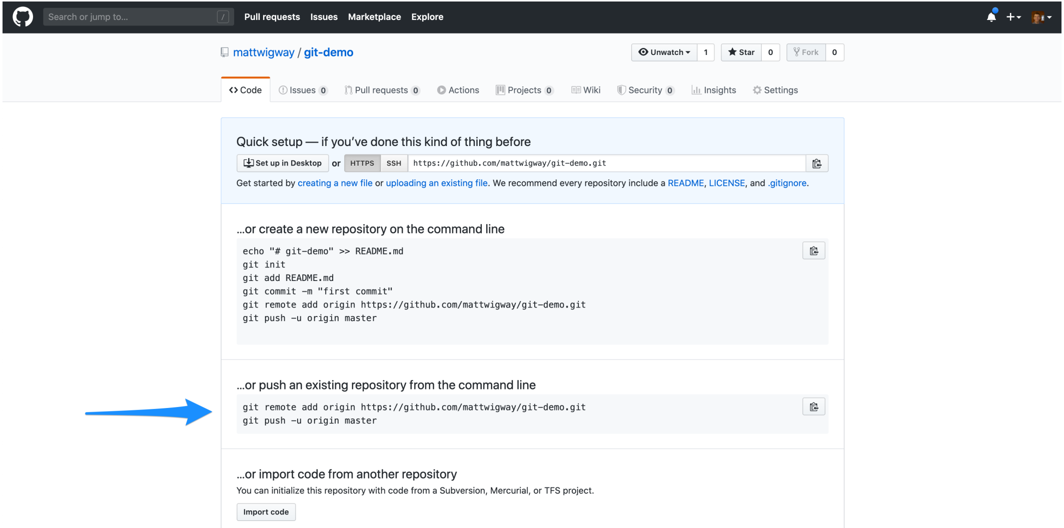
○ **Private**
You choose who can see and commit to this repository.

Skip this step if you're importing an existing repository.

Leave unchecked → □ **Initialize this repository with a README**
This will let you immediately clone the repository to your computer.

Add .gitignore: **None** Add a license: **None**

Creating a repository



Quick setup — if you've done this kind of thing before

```
https://github.com/mattwigway/git-demo.git
```

Get started by creating a new file or uploading an existing file. We recommend every repository include a README, LICENSE, and .gitignore.

…or create a new repository on the command line

```
echo "# git-demo" >> README.md
git init
git add README.md
git commit -m "first commit"
git remote add origin https://github.com/mattwigway/git-demo.git
git push -u origin master
```

…or push an existing repository from the command line

```
git remote add origin https://github.com/mattwigway/git-demo.git
git push -u origin master
```

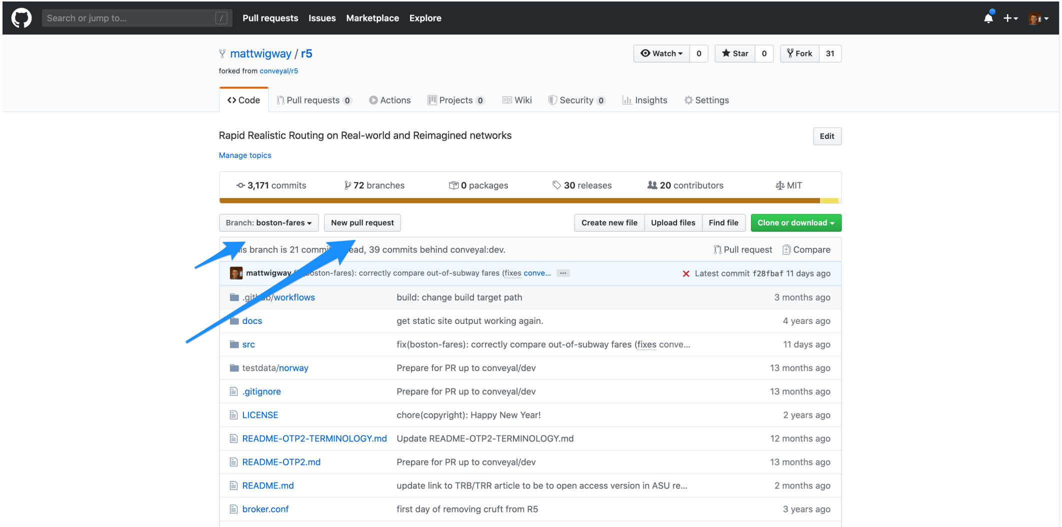
…or import code from another repository

You can initialize this repository with code from a Subversion, Mercurial, or TFS project.

Working with GitHub

- After making commits on your computer: `git push`
  - To push a new branch: `git push -u origin branchname`
- After someone else has made commits: `git pull`
- After someone else has pushed a branch:
  - `git fetch`
  - `git switch <branch name>`

GitHub: using pull requests



mattwigway / r5

forked from conveyal/r5

Rapid Realistic Routing on Real-world and Reimagined networks

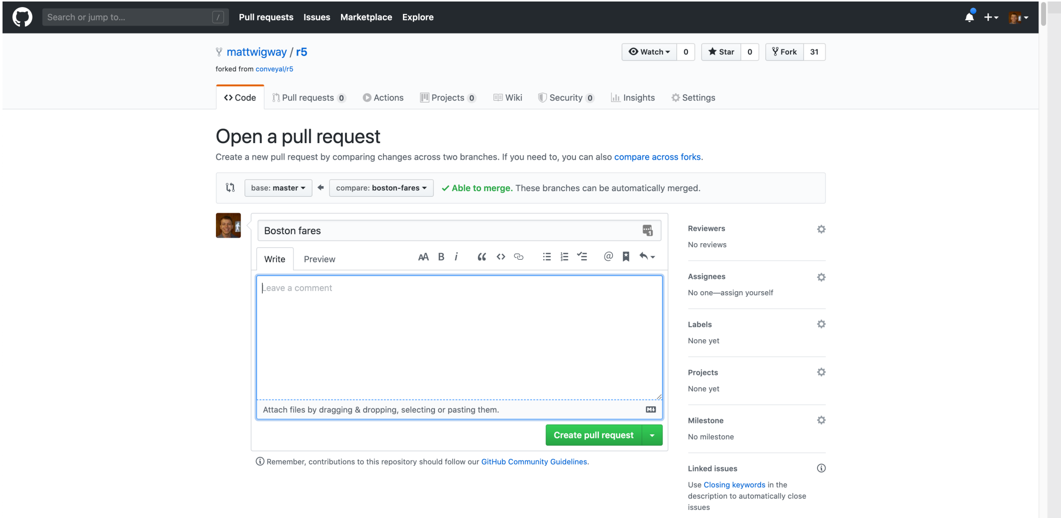
3,171 commits | 72 branches | 0 packages | 30 releases | 20 contributors | MIT

This branch is 21 commits ahead, 39 commits behind conveyal:dev.

mattwigway fix(boston-fares): correctly compare out-of-subway fares (fixes conve... ··· ✕ Latest commit f28fbaf 11 days ago

.github/workflows	build: change build target path	3 months ago
docs	get static site output working again.	4 years ago
src	fix(boston-fares): correctly compare out-of-subway fares (fixes conve...	11 days ago
testdata/norway	Prepare for PR up to conveyal/dev	13 months ago
.gitignore	Prepare for PR up to conveyal/dev	13 months ago
LICENSE	chore(copyright): Happy New Year!	2 years ago
README-OTP2-TERMINOLOGY.md	Update README-OTP2-TERMINOLOGY.md	12 months ago
README-OTP2.md	Prepare for PR up to conveyal/dev	13 months ago
README.md	update link to TRB/TRR article to be to open access version in ASU re...	2 months ago
broker.conf	first day of removing cruft from R5	3 years ago

GitHub: using pull requests



Open a pull request

Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.

base: master ← compare: boston-fares ✓ Able to merge. These branches can be automatically merged.

Boston fares

Write | Preview

Leave a comment

Attach files by dragging & dropping, selecting or pasting them.

Create pull request

Remember, contributions to this repository should follow our GitHub Community Guidelines.

Reviewers: No reviews

Assignees: No one—assign yourself

Labels: None yet

Projects: None yet

Milestone: No milestone

Linked issues: Use Closing keywords in the description to automatically close issues

GitHub: using pull requests

Live demo: `https://github.com/mattwigway/git-demo/pull/1`

Best practices for collaboration using GitHub

- Work on your own branch
- When you’re ready to share your code with the team, make a pull request
- Have others review the pull request before merging

Questions/Contact

mwconway@asu.edu
@mattwigway

Other resources:

- `git` book: `https://git-scm.com/book/`
- GitHub help: `https://help.github.com`