

Version Control git + GitHub

Marco Morales Nana Yaw Essuman
marco.morales@columbia.edu nanayawce@gmail.com

GR5069
Topics in Applied Data Science
for Social Scientists

Spring 2022
Columbia University

Before we begin...

Housekeeping (I): ISO a note-taker for this class

- ▶ CU is looking for a **note-taker** for this course
 - ▶ **notes** should be **well-organized** and **detailed**
 - ▶ note-taker will be **compensated** (\$250 for the semester)
- ▶ **interested?** submit a sample of your notes to **Emma Johnson** (edj2115@columbia.edu), Assistant Dean of Student Life and Well-being
- ▶ **further details:** see posting on **Slack**

Housekeeping (II): use **Slack!**

- ▶ **Slack** is the **preferred method of communication** for this class!
 - ▶ **sign up** if you haven't already! You should have received an invite in your @columbia email
- ▶ **Slack** will be used for all:
 - ▶ **class announcements**
 - ▶ **questions and comments**
 - ▶ **discussions**
 - ▶ you'll get a quicker answer there

Housekeeping (II): questions on Slack!

- ▶ **is it possible that others have a similar question?** post your question in the appropriate channel using the **@channel** handle (we'll all chime in!)
- ▶ **is it only relevant to you?** create a **private channel** including instructors and TAs (you'll get a quicker answer!)
- ▶ **email** will be reserved for **official communications** only!

Housekeeping (III): timely use of **Slack!**

- ▶ we're seeking to generate **collaborative discussions** through Slack **before our live sessions**
- ▶ that requires students and instructors to have **enough time to respond**
- ▶ please:
 - ▶ check **annotated materials, lecture recordings, assignments** for the coming week **immediately after class**
 - ▶ do your readings, assignments and exercises **early in the week** (do not leave them to the last minute)
 - ▶ **post questions and comments** with **sufficient anticipation** to allow for meaningful interactions (i.e. not a few hours before class)

Housekeeping (IV): GitHub handles for GitHub classroom

- ▶ please fill out the Google sheet — link in **Slack** with your GitHub handle
- ▶ students registered for the course will be added to GitHub classroom this weekend!
- ▶ **Homework #1** will be available on Monday and due next Monday

Now, let's get started!

A Data Science project...

Three **aims** of a Data Science project

a) **reproducibility**

- ▶ anyone should be able to arrive to your **same results**

b) **portability**

- ▶ anyone should be able to **pick up where you left off** on any machine

c) **scalability**

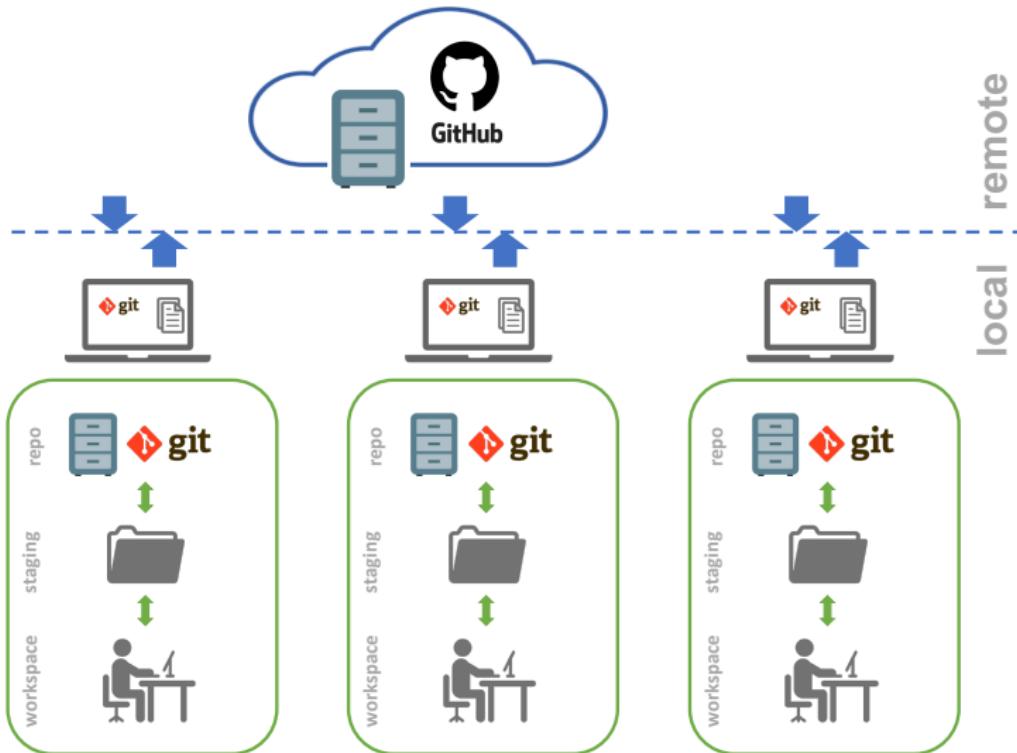
- ▶ your project should also work for **larger data sets** and/or be on the path of **automation**

a) and b) crucial for **collaborative work**

Why version control?

- ▶ **version control** allows you to keep track of changes / progress in your code
 - ▶ keeps “**snapshots**” of your code over time
 - ▶ helpful to **debug**, and to enhance **reproducibility**
 - ▶ also great for **team collaboration** (everyone can see who changed what!) and **portability**
- ▶ **git** is a version control software
- ▶ **GitHub** is an online open source repository

An ideal version control setup for collaboration

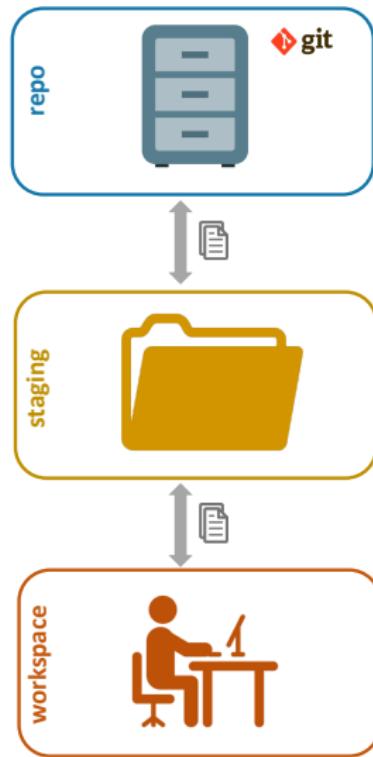


git locally

recap: what was this **git** thing?

- ▶ **git** is a version control software
 - ▶ installed “locally” on your computer (or virtual machine)
 - ▶ keeps snapshots of your (coding) work
- ▶ helps with
 - ▶ “time travel” (insert your favorite “Back to the future” gif here)
 - ▶ keep collaboration organized when multiple people are working on the same project
- ▶ a vehicle to be nice to your fellow collaborators (and to the you of the future)

git: a mental model



Introduce yourselves: git, meet your new user!

from the command line:

- ▶ set your **user name** and **email address**

```
$ git config --global user.name "John Doe"
```

```
$ git config --global user.email johndoe@example.com
```

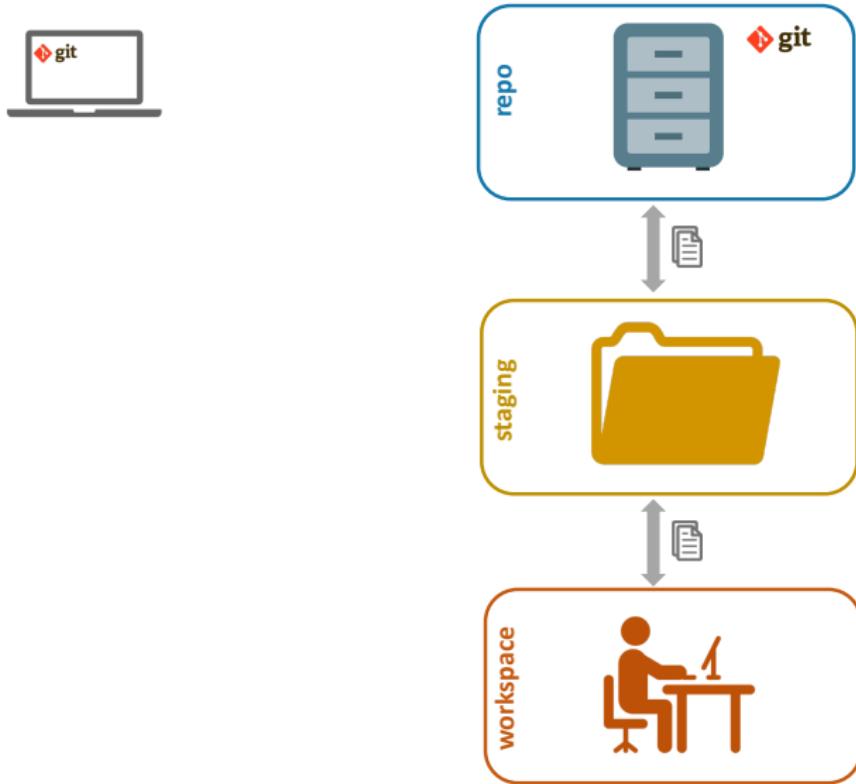
- ▶ **verify** that information was successfully entered

```
$ git config --list
```

- ▶ this information gets baked in your commits

- ▶ **ProTip:** other useful information (e.g. proxy settings) also goes on `git config`

now, turn your folder structure into a git repo



now, turn your folder structure into a git repo

from the command line:

- ▶ go to the **root** of your project and **initialize** the repo

```
$ git init
```

- ▶ there are **files you never want tracked** by git (e.g. log files, access keys), even by mistake
- ▶ from the root of your local repository, create a `.gitignore` file

```
$ touch .gitignore      (Mac)
```

```
$ echo > .gitignore     (Windows)
```

- ▶ add files you want git to ignore in the `.gitignore` file

what could go into a .gitignore file ?

```
# OS generated files #
*.DS_Store

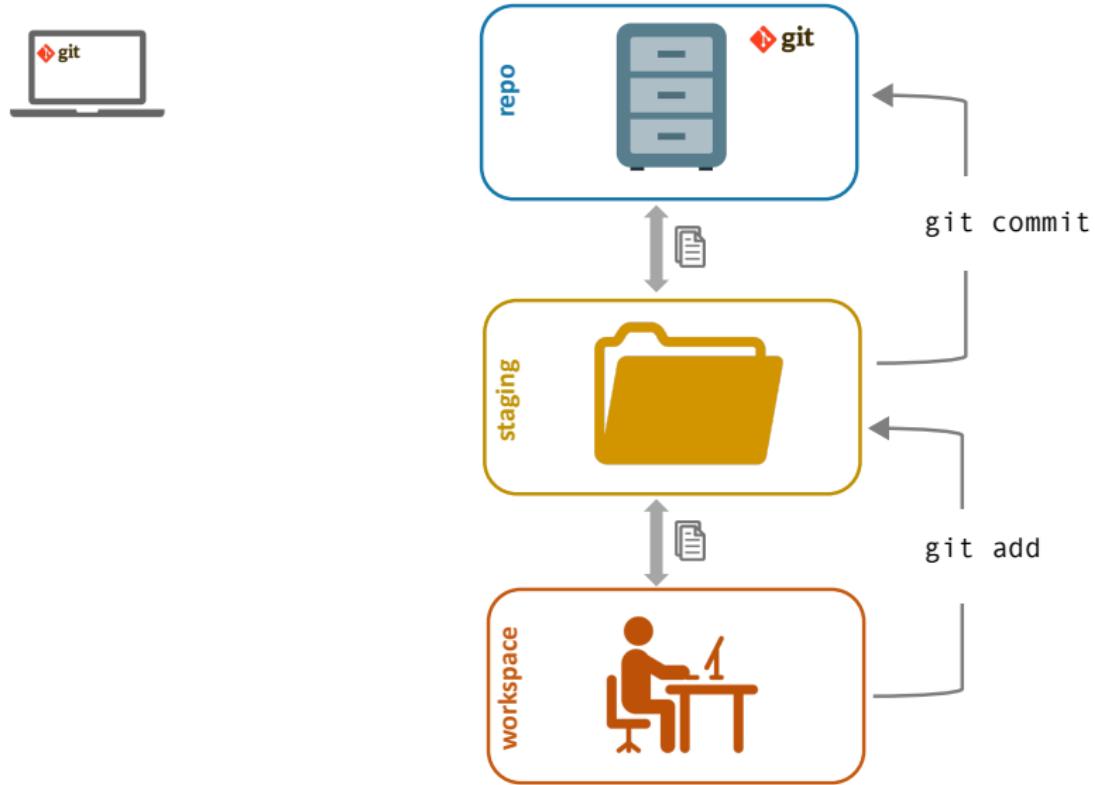
# Jupyter Notebook
.ipynb_checkpoints

# RStudio files
*.Rproj.user/

# all data folders
data/
```

- ▶ **ProTip:** further info/templates:
<https://github.com/github/gitignore>

your basic git workflow



your basic git workflow

from the command line:

- ▶ indicate a file to be tracked by git

```
$ git add samplefile.R
```

- ▶ verify what's being tracked

```
$ git status
```

- ▶ commit your tracked files (with an informative message)

```
$ git commit -m "Commit initial files"
```

a few confusing things about git

- ▶ a file will be committed **exactly** as it was when you `git add-ed` it
- ▶ if you change the file **after** you `git add` it, and want to commit the new changes, you need to `git add` again before the `git commit`
- ▶ use `git status` to assess what's being staged and will be committed

git workflow ProTips

- ▶ **NEVER** use `git add .`
- ▶ use `git status` often as **validation**
- ▶ only add and commit **source files**
 - ▶ omit files you can reproduce using source files
- ▶ commit **small chunks of logically grouped changes**
 - ▶ you may want to undo a change, and only that change
- ▶ commit with **informative** (imperative mood) **messages**
 - ▶ *[this commit will]* Rename income variable

git workflow ProTips

A quick detour: master vs main branch

- ▶ **Pro Tip:** current best practice is to use main for your default branch; used to be master
- ▶ by default, git will create a main branch after your first commit
- ▶ easy to rename your branch to main

```
$ git branch -M main
```

- ▶ for a permanent solution (in git >= 2.28)

```
$ git config --global init.defaultBranch main
```

push globally (to GitHub)

recap: what was this **GitHub** thing?

- ▶ **GitHub** is a cloud service that hosts **git** repositories
 - ▶ lives in the cloud
 - ▶ understands the git dialect!
 - ▶ can speak with multiple git users simultaneously
- ▶ helps with
 - ▶ persisting repository storage (your dog cannot eat your repo!)
 - ▶ synchronizing work
 - ▶ minimizing risk of people stepping on each other's toes (while working on the same project)
 - ▶ seamless transition between environments (dev > staging > prod)

first, create a GitHub repo to store/share in the cloud

Create a new repository

A repository contains all the files for your project, including the revision history.

Owner



marco-morales ▾

Repository name

testrepo



Great repository names are short and memorable. Need inspiration? How about friendly-octo-guide.

Description (optional)

a test repository



Public

Anyone can see this repository. You choose who can commit.



Private

You choose who can see and commit to this repository.

Initialize this repository with a README

This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.

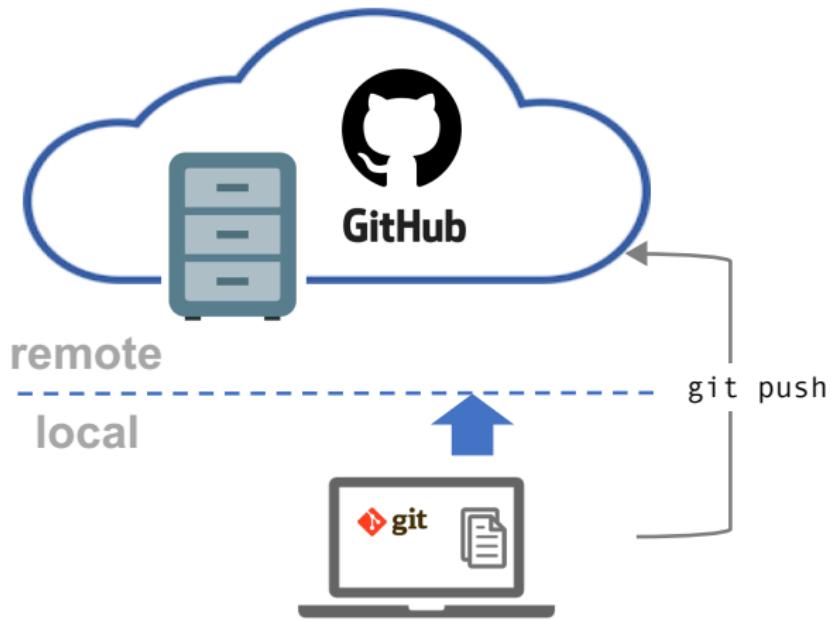
Add .gitignore: None ▾

Add a license: None ▾



Create repository

then, push to that GitHub repo



then, push to that GitHub repo

from the command line:

- ▶ tell git the **location** of the remote GitHub repo you just created (typically nicknamed “origin”)

```
$ git remote add origin  
https://github.com/marco-morales/testrepo.git
```

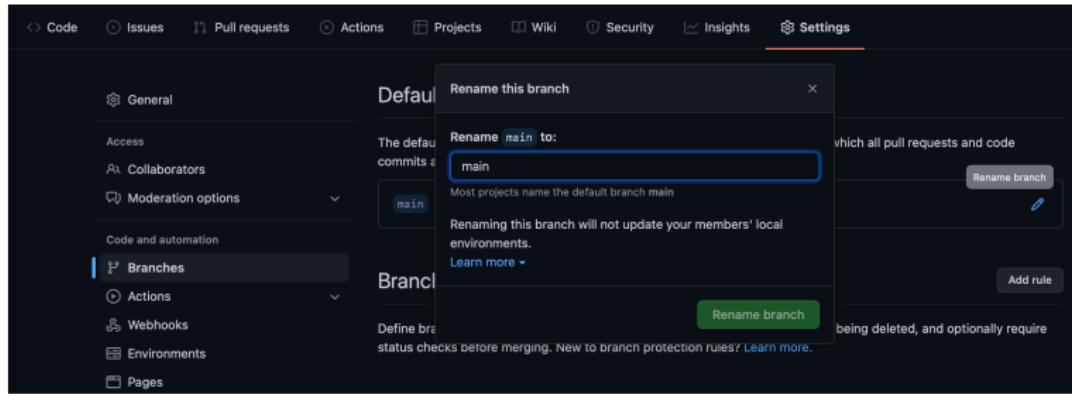
- ▶ send **committed files** to your GitHub (“origin”) repo from your local git branch (“main”)

```
$ git push -u origin main
```

GitHub workflow ProTips

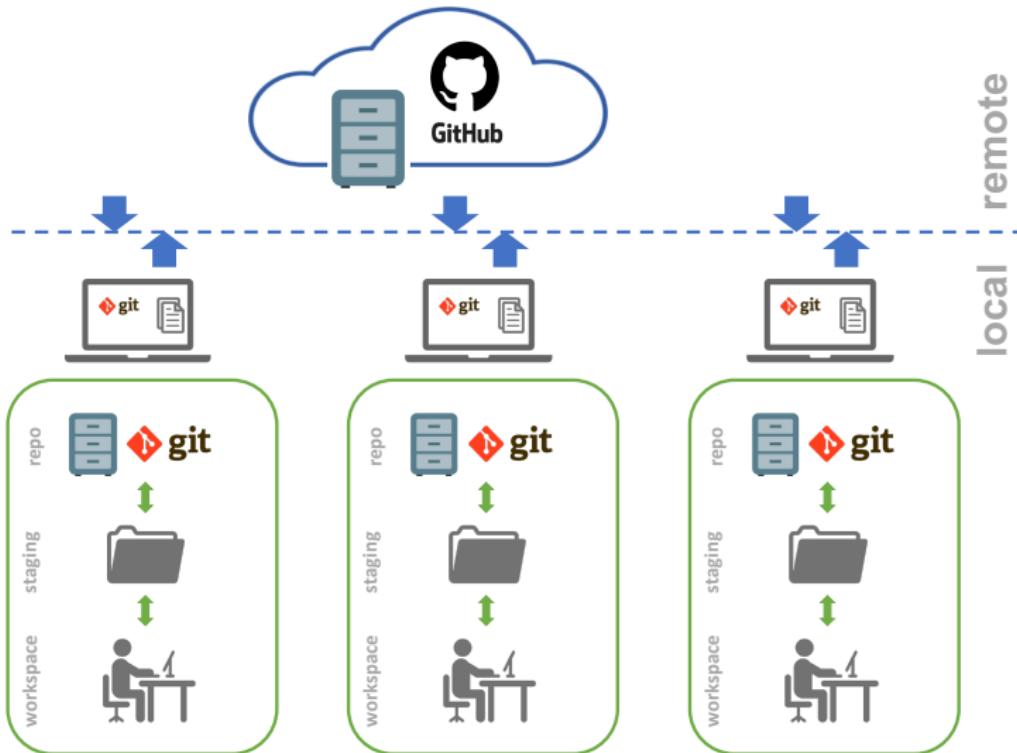
A quick detour: master vs main branch

- ▶ **Pro Tip:** current best practice is to use main for your default branch; used to be master
- ▶ by default, GitHub will create a `master` branch after your first create a repo if you do not change defaults
- ▶ easy to change permanently in your GitHub settings



git+GitHub for team collaboration

all the building blocks are now in place



now, enable collaborators in your GitHub repo

marco-morales / testrepo

Unwatch 2 Star 0 Fork 0

Code Issues 0 Pull requests 1 Projects 1 Wiki Insights Settings

Options

Collaborators

Branches

Webhooks

Notifications

Integrations & services

Deploy keys

Moderation

Interaction limits

Collaborators

Push access to the repository

 gulbzrh

Search by username, full name or email address

You'll only be able to find a GitHub user by their email address if they've chosen to list it publicly. Otherwise, use their username instead.

gulbzrh Add collaborator

important to know what each role can do

- ▶ add **collaborators** to your repo
 - ▶ as a repo **owner** you have control over what gets changed
 - ▶ **collaborators** will be able to **push** to the repo

a) **Collaborators:**

- ▶ work on a branch on the repo and create code
- ▶ send a **pull request** to add that code to the master repo

b) **Owner:**

- ▶ comment on the **pull request**
- ▶ accept the **pull request** and/or **merge** the code

(1) a collaborator creates a branch to work on, that will eventually be merged back to the main branch

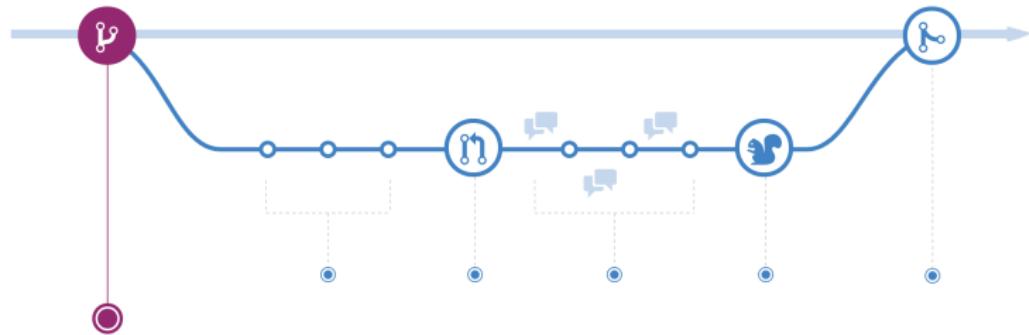


Figure: Understanding the GitHub flow

- ▶ changes in a branch do not affect the `master` branch
- ▶ ***ProTips***
 - ▶ anything in the `main` branch is deployment-ready
 - ▶ the branch should always be created off of the `main` branch

(2) a collaborator works and commits on that branch

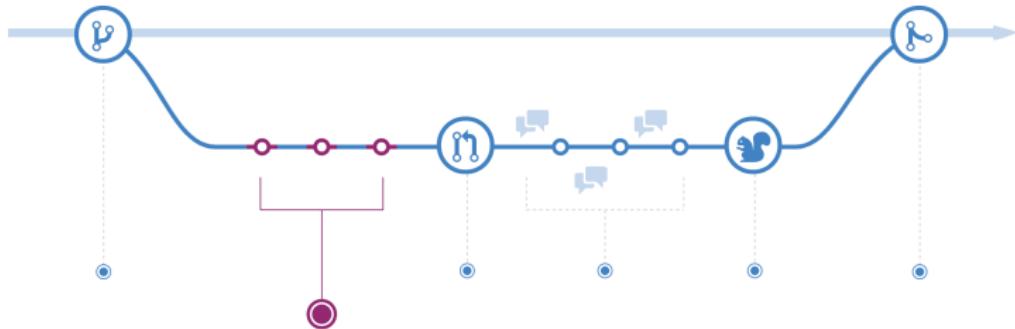


Figure: Understanding the GitHub flow

- ▶ use the same workflow in a branch: `git add`, `git status`, `git commit`
- ▶ ***ProTip***
 - ▶ use informative messages in your branch commits

(3) a collaborator pushes to create a pull request

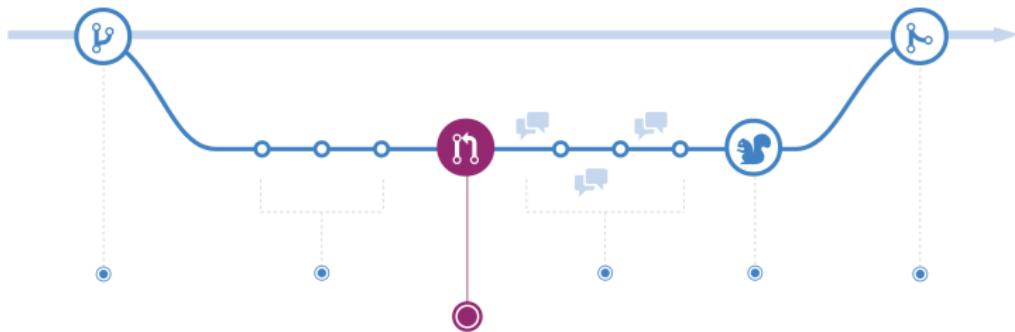


Figure: Understanding the GitHub flow

- ▶ a pull request notifies that your changes are ready to be reviewed and merged back to the main branch
- ▶ the review will validate that the changes do not create problems in the main branch and incorporate other members' comments

(3) a collaborator pushes to create a pull request

The screenshot shows a GitHub repository page for 'marco-morales / testrepo'. The top navigation bar includes links for Code, Issues (0), Pull requests (1), Projects (1), Wiki, Insights, and Settings. A modal window titled 'Label issues and pull requests for new contributors' is displayed, explaining that GitHub will help first-time contributors discover issues labeled with 'help wanted' or 'good first issue'. Below the modal, there are filters for 'Filters', a search bar containing 'is:pr is:open', and buttons for 'Labels', 'Milestones', and 'New pull request'. The main content area shows a single open pull request from 'Melissabbranch' with the number '#2' and a note indicating it was opened on Feb 7, 2018 by marco-morales. At the bottom, a ProTip! message suggests using 'g i' on an issue or pull request to go back to the listing page.

marco-morales / testrepo

Code Issues (0) Pull requests 1 Projects 1 Wiki Insights Settings

Label issues and pull requests for new contributors

Now, GitHub will help potential first-time contributors discover issues labeled with [help wanted](#) or [good first issue](#)

Dismiss

Filters is:pr is:open Labels Milestones New pull request

1 Open ✓ 1 Closed

Author ▾ Projects ▾ Labels ▾ Milestones ▾ Reviews ▾ Assignee ▾ Sort ▾

Melissabbranch
#2 opened on Feb 7, 2018 by marco-morales

ProTip! Type [g i](#) on any issue or pull request to go back to the issue listing page.

(4) an owner reviews changes, resolves conflicts, and approves the merge

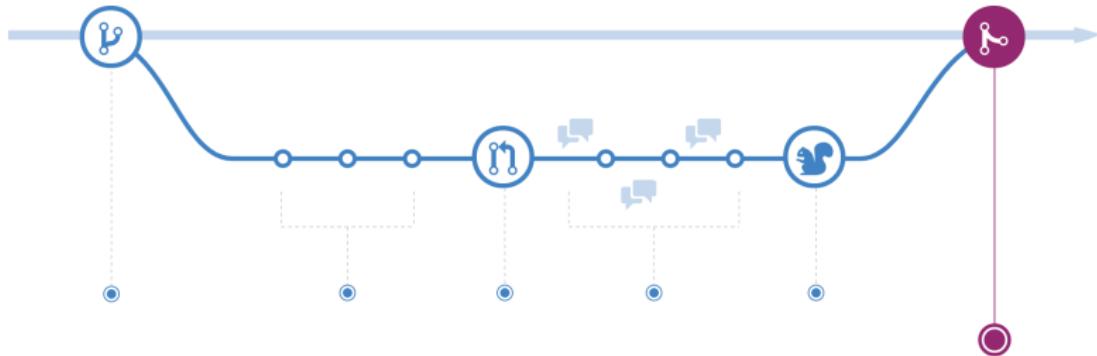


Figure: Understanding the GitHub flow

- ▶ once the proposed changes have been validated they are merged back into the main branch
- ▶ the merge preserves records of changes made on the branch

(4) an owner reviews changes, resolves conflicts, and approves the merge

marco-morales / testrepo

Code Issues 0 Pull requests 1 Projects 1 Wiki Insights Settings

Melissabbranch #2

Open marco-morales wants to merge 3 commits into master from melissabbranch

Conversation 0 Commits 3 Checks 0 Files changed 1

Changes from all commits ▾ File filter... ▾ Jump to... ▾ +1 -1

Diff settings Review changes

2 testfile.R

3	3	@@ -3,4 +3,4 @@
4	4	### this is a test fi
5	5	print("Hello World!")
6	-	print(";")
6	+	print("Hello World!!")

Leave a comment

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

Comment
Submit general feedback without explicit approval.

Approve
Submit feedback and approve merging these changes.

Request changes
Submit feedback that must be addressed before merging.

Submit review

© 2019 GitHub, Inc. Terms Privacy Security

rinse and repeat



a quick exercise

a quick exercise

from the command line:

- ▶ go to a brand new location
- ▶ clone somebody else's remote repo

```
$ git clone  
https://github.com/marco-morales/testrepo.git
```

- ▶ (checkout and) create a branch

```
$ git checkout -b mytestbranch-myname
```

- ▶ make a change in your code file
- ▶ go on, verify that git is tracking the change

```
$ git status
```

a quick exercise

from the command line:

- ▶ do your usual git routine

```
$ git add testfile.R
```

```
$ git commit -m "Add hubris to the code"
```

- ▶ now, you'll create a pull request

```
$ git push origin mytestbranch-myname
```

- ▶ time for the repo owner to intervene!

Version Control git + GitHub

Marco Morales Nana Yaw Essuman
marco.morales@columbia.edu nanayawce@gmail.com

GR5069
Topics in Applied Data Science
for Social Scientists

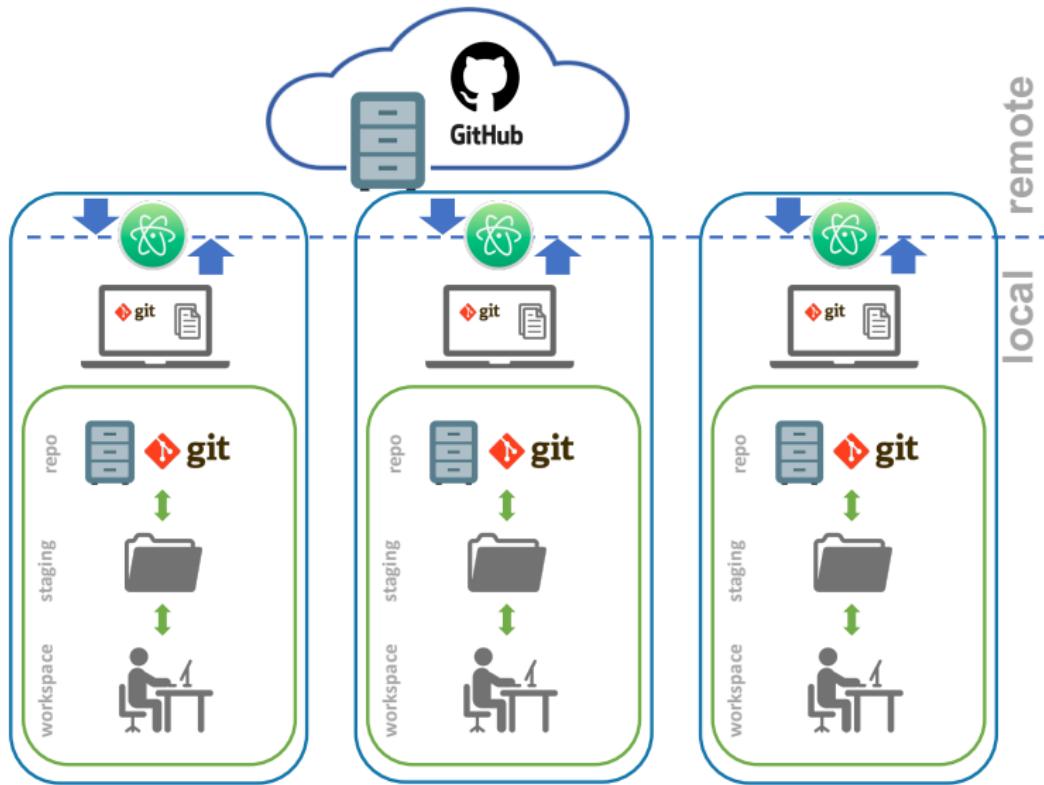
Spring 2022
Columbia University

Your Friendly Neighborhood Atom

a simpler workflow is possible

- ▶ we've been working with git+GitHub from the **command line**
 - ▶ it can get confusing and harder than necessary at times
- ▶ now that you understand the flow, we can make our lives easier with an **IDE** (Integrated Development Environment)
- ▶ our preferred IDE today → **Atom**
 - ▶ it can seamlessly handle git + GitHub interaction, and coding needs

a git+GitHub workflow through an IDE



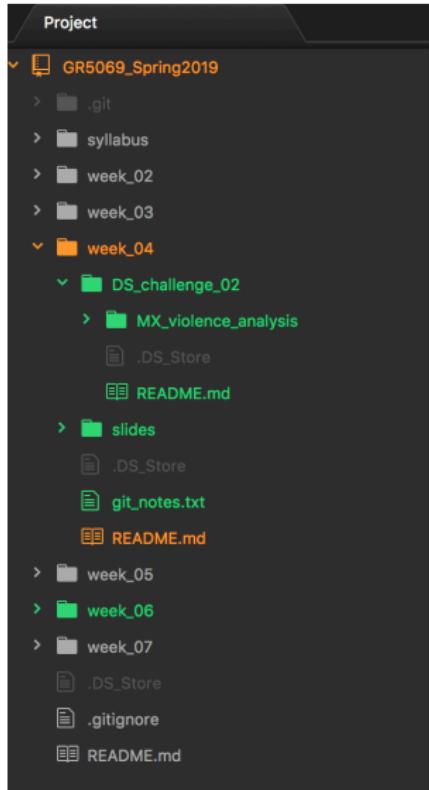
a git+GitHub workflow through an IDE

The screenshot shows a GitHub for Mac interface integrated with an IDE (Atom). The left sidebar displays a project structure for 'git+GitHub_Spring2019' with various files and folders like 'git', 'README.md', 'week_01', 'week_02', 'week_03', 'week_04', 'OS_challenge_02', 'MX_violence_analysis', 'slides', 'git_notes.txt', 'week_05', 'week_06', 'week_07', 'DS_Store', '.gitignore', and 'README.md'. The main pane shows an 'Unstaged Changes' view for 'week_04/README.md' with the following content:

```
21 21
22 22 * the GitHub YouTube channel [GitHub training series](https://www.youtube.com/GitHub)
23 23 * [GitHub Learning Lab](https://lab.github.com) hands-on tutorials put together by GitHub
24 24 * [Understanding the GitHub flow](https://guides.github.com/introduction/flow/) is a 5-minute tutorial
25 25 * [GitHub Help](https://help.github.com/) is a great place to start at the source
26 26
27 27
28 28 Although it's probably best to start with the command line, once you're comfortable coding in a text
29  editor, it might start to make sense to also interact with git and GitHub from your text editor as
30  well. Atom is an open source text editor - supported by GitHub - with a nice integration with git and
31  GitHub.
32 32 * [Version Control in Atom](https://flight-manual.atom.io/using-atom/sections/version-control-in-
33  atom/) and [GitHub package](http://flight-manual.atom.io/using-atom/sections/github-package/) chapters
34  from the [Atom Flight Manual](https://flight-manual.atom.io) to understand the basics of working with
35  git and GitHub from Atom
36 36 * [Atom Flight Manual](https://flight-manual.atom.io) if you want to learn more about other packages
37  - that will make it easier to code in your language of choice
```

The right sidebar shows the GitHub interface with 'Unstaged Changes' and 'Staged Changes' sections. The 'Unstaged Changes' section lists several files, with 'week_04/README.md' highlighted. The 'Staged Changes' section shows 'No changes'. At the bottom, there is a 'Commit message' field and a 'Commit to master' button.

a simple way to identify the git status of each file

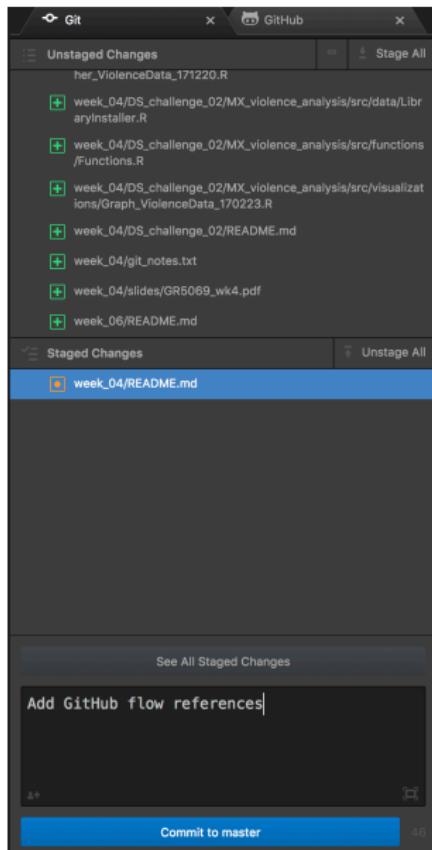


a simple way to git diff on a file

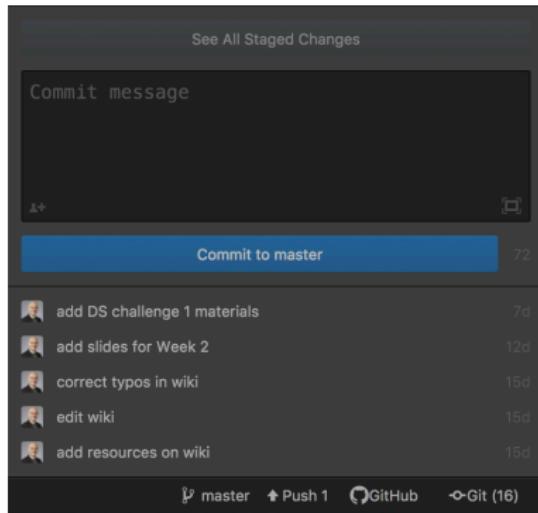
The screenshot shows a GitHub interface with two tabs: 'README.md' and 'Unstaged Changes: week...'. The 'Unstaged Changes' tab is active, displaying the content of 'README.md' with several lines highlighted in green, indicating they have been modified. The code block below shows the raw text of the README file with these modifications.

```
@@ -21,11 +21,12 @@ Git and GitHub have done a great job of putting together and facilita...
21 21
22 * the GitHub YouTube channel [GitHub training series](https://www.youtube.com/GitHub)
23 * [GitHub Learning Lab](https://lab.github.com) hands-on tutorials put together by GitHub
24 * [Understanding the GitHub flow](https://guides.github.com/introduction/flow/) is a 5-minute tutorial
  * to understand the basics of team collaboration through GitHub
25 * [GitHub Help](https://help.github.com/) is a great place to start at the source
26
27 ## Atom
28
29 Although it's probably best to start with the command line, once you're comfortable coding in a text
  * editor, it might start to make sense to also interact with git and GitHub from your text editor as
  * well. Atom is an open source text editor – supported by GitHub – with a nice integration with git and
    GitHub.
30
31 * the [Version Control in Atom](https://flight-manual.atom.io/using-atom/sections/version-control-in-
  * atom/) and [GitHub package](http://flight-manual.atom.io/using-atom/sections/github-package/) chapters
  * from the [Atom Flight Manual](https://flight-manual.atom.io) to understand the basics of working with
  * git and GitHub from Atom
32 * [Atom Flight Manual](https://flight-manual.atom.io) if you want to learn more about other packages
  * that will make it easier to code in your language of choice
```

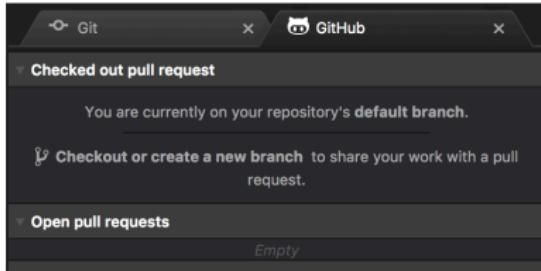
all your git workflow (add, commit) on a single screen



all your git workflow (push) on a single screen



all your GitHub workflow on a single screen



**Though this be madness,
yet there's method in't**

Recap: the method to this version control madness...

- ▶ basic **actions** to master in git
 - ▶ `git init`: initializes git, and indicates that the folder should be tracked
 - ▶ `git add`: brings new files to the attention of git to be tracked as well
 - ▶ `git commit`: takes a snapshot of alerted files
 - ▶ `git push`: sends changes committed in your branch (of your local repo) to the remote branch (of the GitHub repo)

Recap: the method to this version control madness...

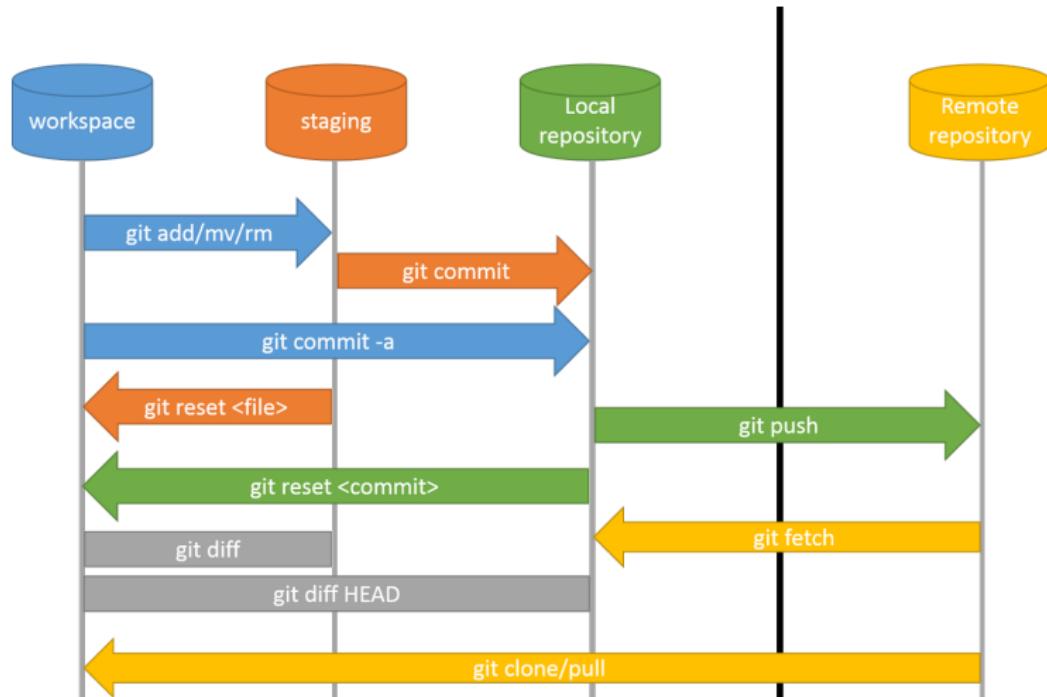


Figure: Pro Git, 2nd Edition

Version Control git + GitHub

Marco Morales Nana Yaw Essuman
marco.morales@columbia.edu nanayawce@gmail.com

GR5069
Topics in Applied Data Science
for Social Scientists

Spring 2022
Columbia University