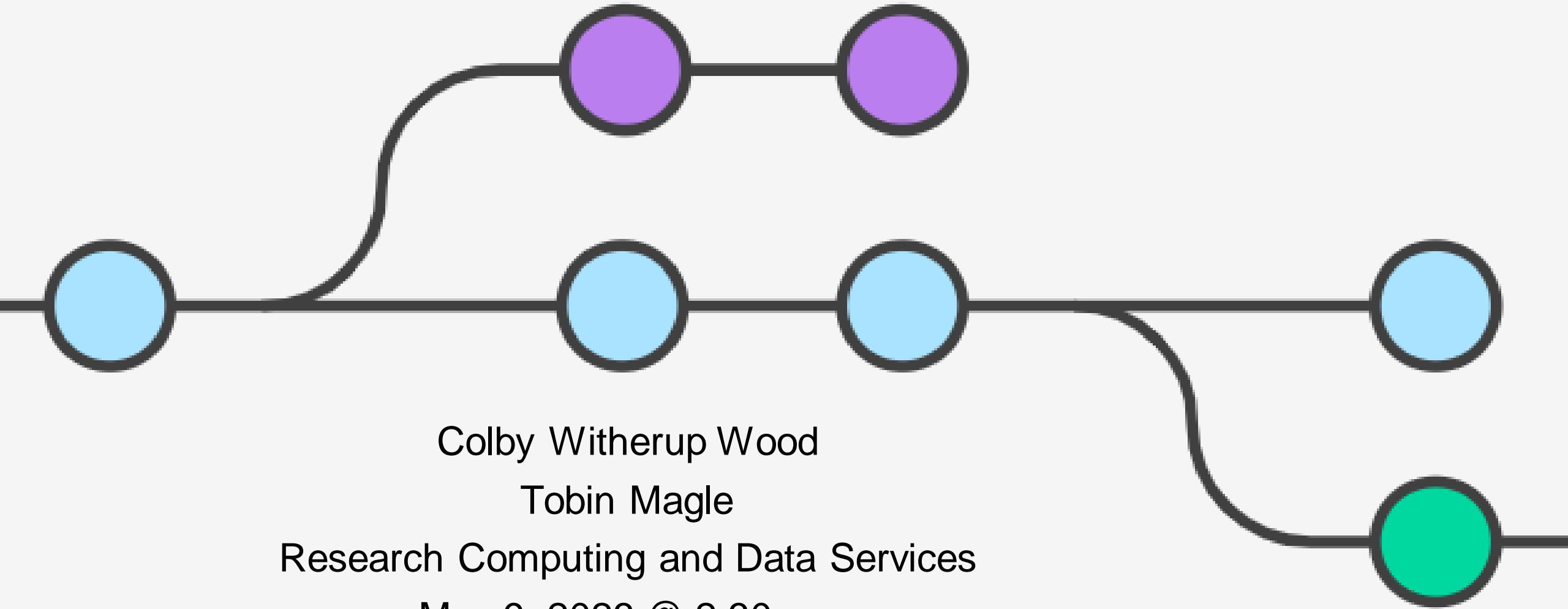


Version control using GitHub



Today we're going to cover:

- What is **version control**?
- What is **git**?
- Version control using **GitHub**
- **Collaboration** in GitHub



Manual Version Control

“Renaming files”

- Creates many files
- Relies on your ability to name files consistently
- Not designed for collaboration

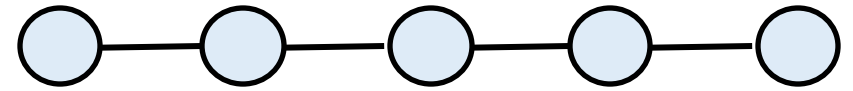


Version Control Systems

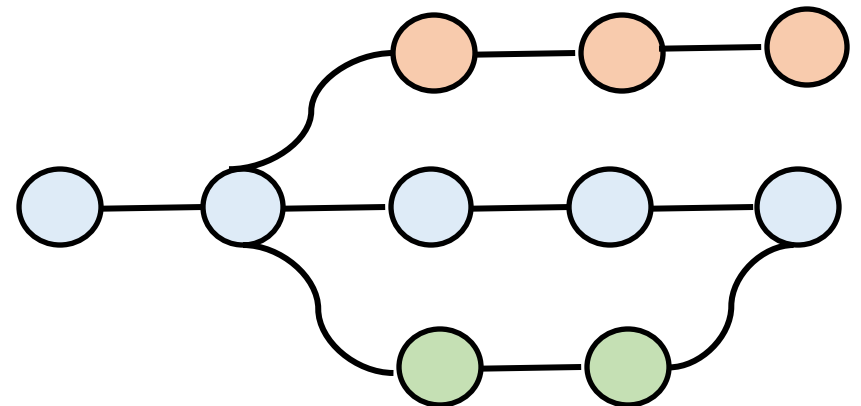
“Unlimited undo”

- One file, many versions
- Records who made what change when
- Good for **collaboration**: identifies and helps resolve conflicting changes

Solo



Collaborative



Today we're using git

- Built for large software development projects
- Can get complicated, but the basics are simple
- Free, open source
- Many online resources/tutorials



Ways to use Git

Command line

```
C:\Windows\System32\cmd.exe

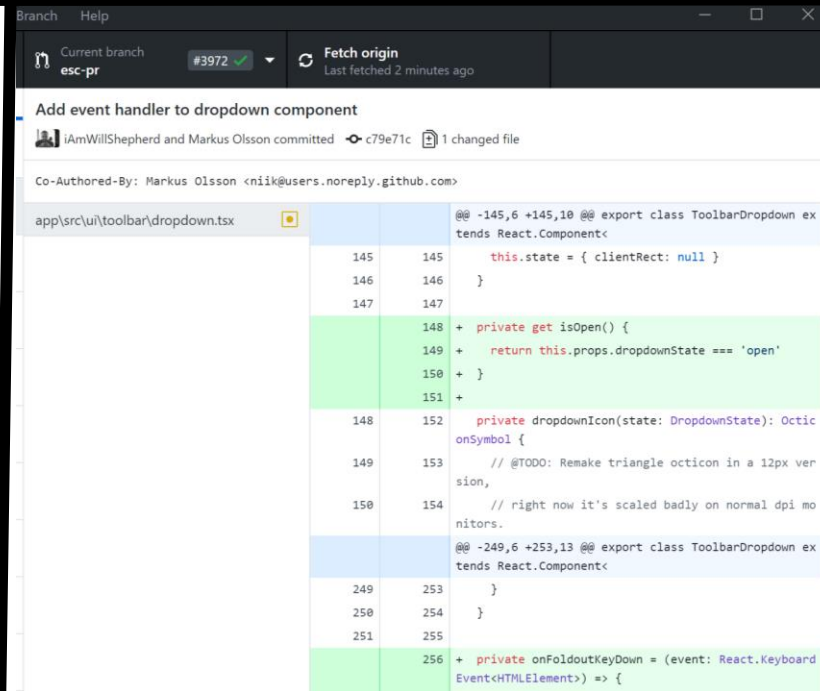
D:\GFG>git status
On branch master

Initial commit

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

    new file:   Basic Code/C++ Project.cbp
    new file:   Basic Code/README.md
    new file:   Basic Code/bin/Debug/C++ Project.exe
    new file:   Basic Code/data.in
    new file:   Basic Code/data.out
    new file:   Basic Code/main.cpp
    new file:   Basic Code/obj/Debug/main.o
    new file:   DS/stackPar.cpp
    new file:   DS/stackPar.exe
    new file:   DS/stackPar.o
    new file:   DS/stlSort.cpp
    new file:   DS/structcar.cpp
    new file:   DS/triplesum.cpp
    new file:   Debugging/Debugging.cbp
    new file:   Debugging/Debugging.depend
    new file:   Debugging/Debugging.layout
    new file:   Debugging/bin/Debug/Debugging.exe
    new file:   Debugging/bin/Release/Debugging.exe
    new file:   Debugging/main.cpp
    new file:   Debugging/obj/Debug/main.o
    new file:   Debugging/obj/Release/main.o
```

Desktop Clients



GitHub Website

Edited the readme file

Changed the title to something better. Added a bulleted list

main

maglet committed 38 minutes ago Verified

Showing 1 changed file with 5 additions and 2 deletions.

7 README.md

@@ -1,3 +1,6 @@

1 - # github-gui-demo

2

3 - demo for adding and editing files in GitHub

1 + # De

2

3 + Thin

4 + * ad

Ways to use Git

Command line

```
C:\Windows\System32\cmd.exe

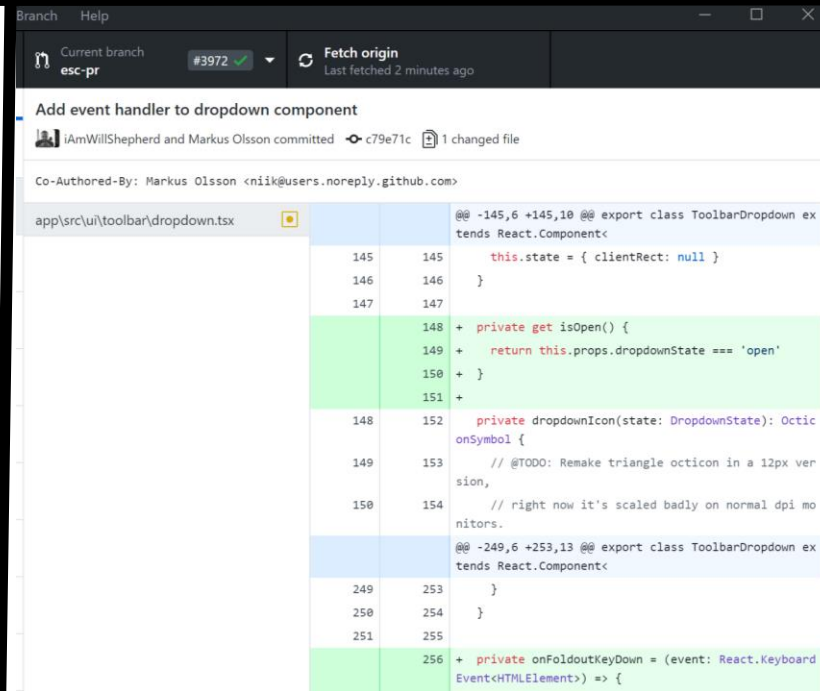
D:\GFG>git status
On branch master

Initial commit

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

    new file:   Basic Code/C++ Project.cbp
    new file:   Basic Code/README.md
    new file:   Basic Code/bin/Debug/C++ Project.exe
    new file:   Basic Code/data.in
    new file:   Basic Code/data.out
    new file:   Basic Code/main.cpp
    new file:   Basic Code/obj/Debug/main.o
    new file:   DS/stackPar.cpp
    new file:   DS/stackPar.exe
    new file:   DS/stackPar.o
    new file:   DS/stlSort.cpp
    new file:   DS/structcar.cpp
    new file:   DS/triplesum.cpp
    new file:   Debugging/Debugging.cbp
    new file:   Debugging/Debugging.depend
    new file:   Debugging/Debugging.layout
    new file:   Debugging/bin/Debug/Debugging.exe
    new file:   Debugging/bin/Release/Debugging.exe
    new file:   Debugging/main.cpp
    new file:   Debugging/obj/Debug/main.o
    new file:   Debugging/obj/Release/main.o
```

Desktop Clients



GitHub Website

Edited the readme file

Changed the title to something better. Added a bulleted list

main

maglet committed 38 minutes ago Verified

Showing 1 changed file with 5 additions and 2 deletions.

7 README.md

@@ -1,3 +1,6 @@

1 - # github-gui-demo

2

3 - demo for adding and editing files in GitHub

1 + # De

2

3 + Thin

4 + * ad

GitHub

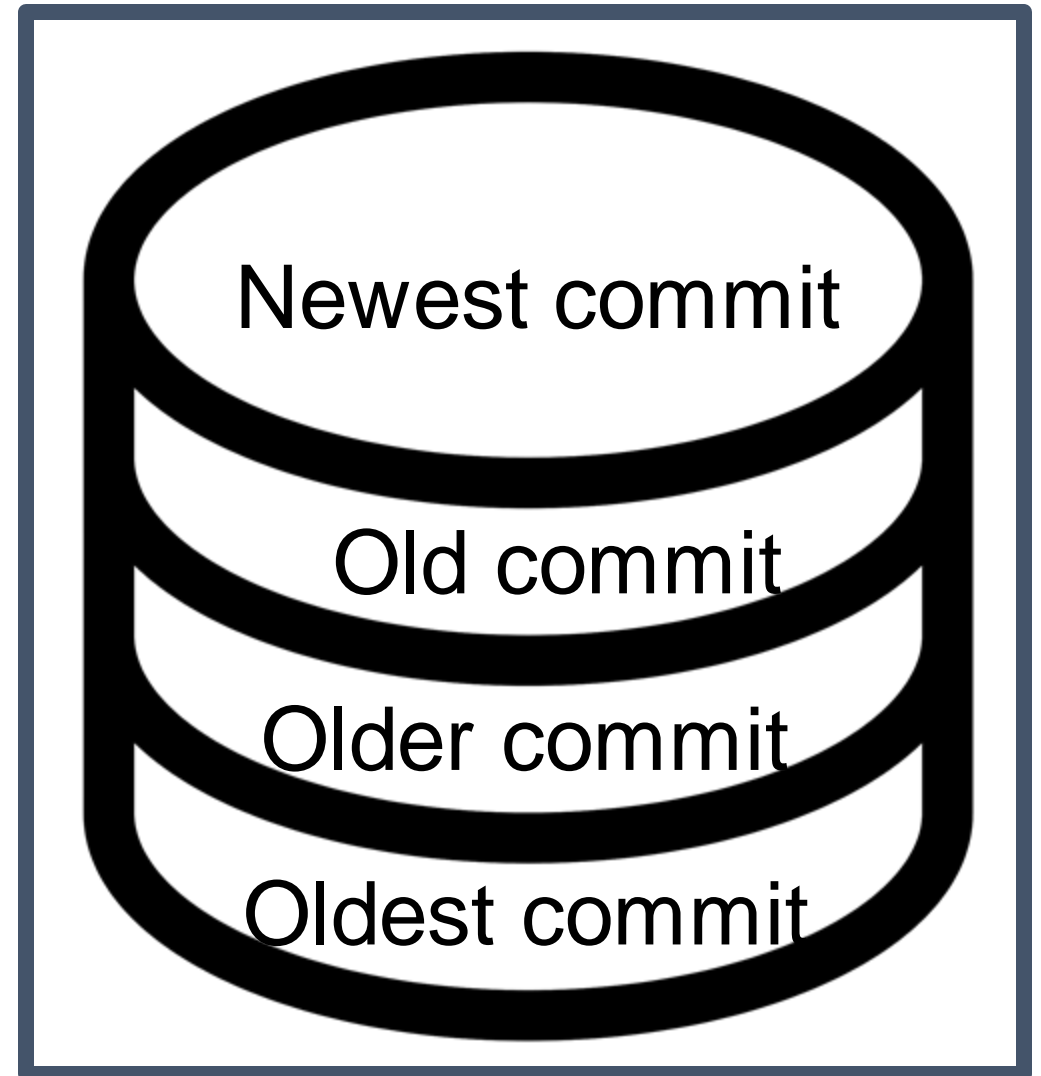
- A place to store your work remotely
 - Free public repositories
 - Unlimited private repositories with Northwestern GitHub Org
- Can edit files in the web browser
- Collaborate



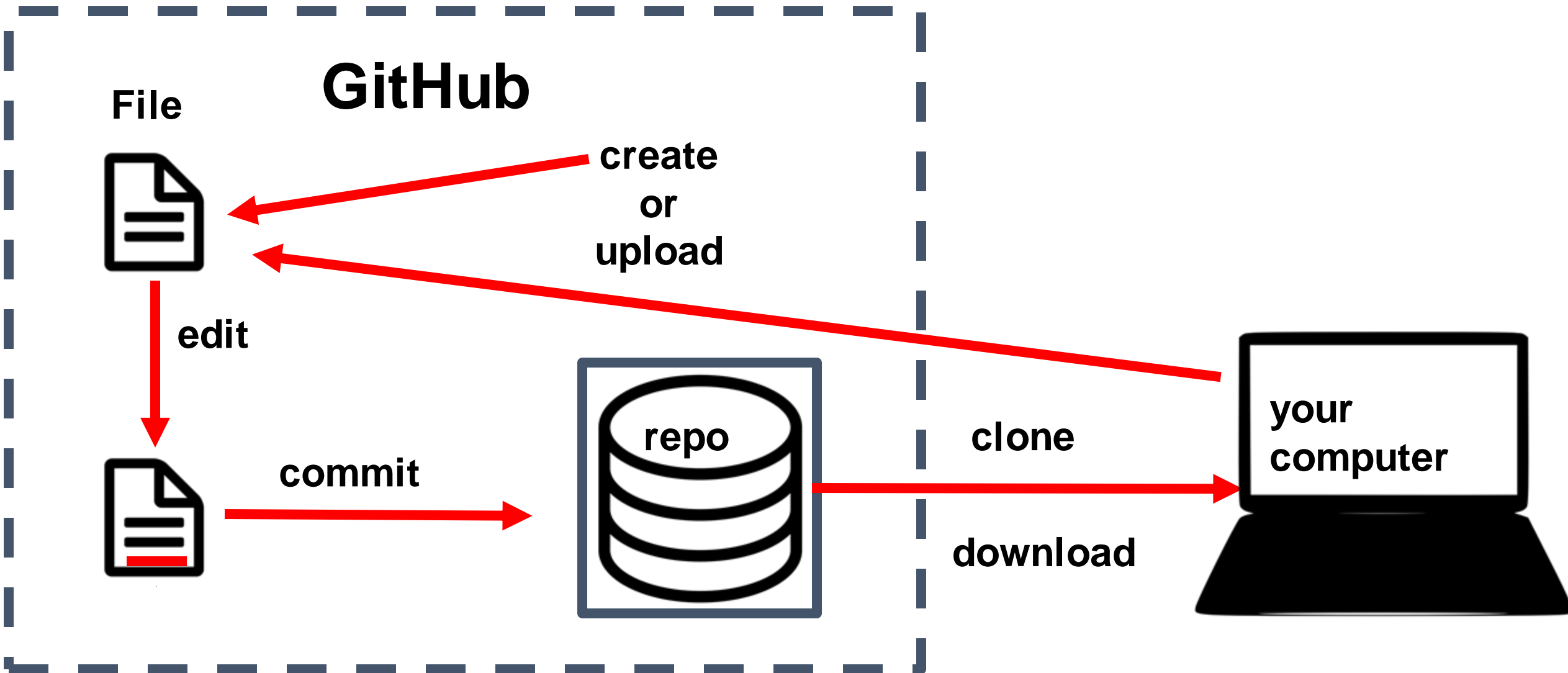
<https://services.northwestern.edu/TDClient/30/Portal/Requests/ServiceDet?ID=55>

GitHub jargon

- **Commit** - save your changes to the files in the repository – each has a unique id
- **Repository** (“repo”) - a running log of changes that were committed - all you see is the most recent version
- **Blame** – who changed what
- **History** - a list of commits
- **Diff** - compare what has changed between versions line by line



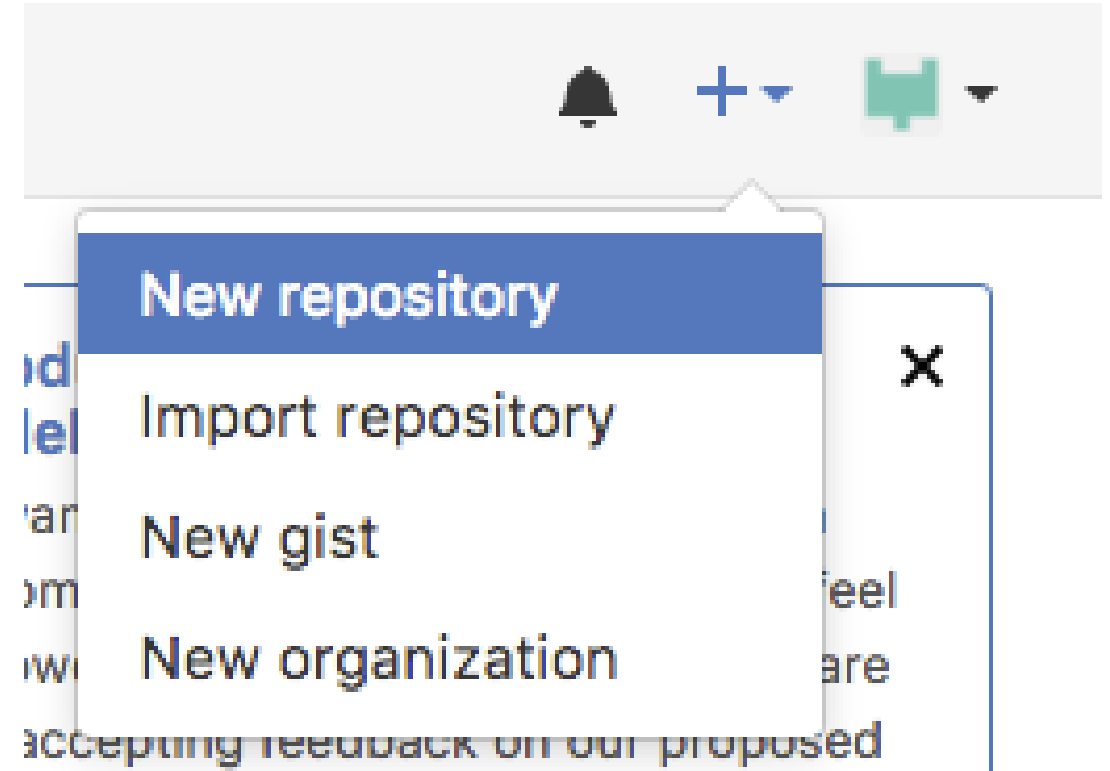
GitHub workflow overview





Make an empty GitHub repo

- Go to <http://github.com>
- Click the plus sign on the upper right hand side of the screen
- Select New repository



Make an empty repository


Name your repository

Provide a description

Keep it public

Initialize with a README


Create a repo


Owner:  maglet ▾ /

Repository name *


Great repository names are short and memorable. Need inspiration? How about [miniature-octo-broccoli](#)?

Description (optional)

☒  **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

What you should see

The screenshot shows the GitHub interface for the repository 'maglet / github-gui-demo'. The repository is public and has 1 watch, 0 forks, and 0 stars. The 'Code' tab is selected, showing the 'main' branch. A recent commit by 'maglet' is highlighted with a red box, showing the update of 'README.md'. Below this, another red box highlights the 'Rendered README doc' which displays the repository name 'github-gui-demo' and its description 'demo for adding and editing files in GitHub'.

maglet / [github-gui-demo](#) Public

Pin Unwatch 1 Fork 0 Star 0

<> Code Issues Pull requests Actions Projects Wiki Security ...

main Go to file Add file <> Code About

maglet Update README.md Files now 7

README.... Update README.md now

README.md Rendered README doc

github-gui-demo

demo for adding and editing files in GitHub

Readme 0 stars 1 watching 0 forks

What you should see

The screenshot shows a GitHub repository page for 'maglet/github-gui-demo'. The repository is public and has 1 watcher, 0 stars, and 0 forks. The 'Code' tab is selected, showing the 'main' branch. The repository description is 'demo for adding and editing files in GitHub'. The README file is highlighted with a red box, and the text 'github-gui-demo' is also highlighted with a red box. The text 'Repo name' is written in red below the repository description.

maglet / **github-gui-demo** Public

Pin Unwatch 1 Fork 0 Star 0

Code Issues Pull requests Actions Projects Wiki Security

main Go to file Add file <> Code About

maglet Update README.md now 7

README.... Update README.md Text now

README.md

github-gui-demo

demo for adding and editing files in GitHub

Readme 0 stars 1 watching 0 forks

Repo name

What you should see

The screenshot shows the GitHub interface for the repository 'maglet / github-gui-demo'. The repository is public and has 1 watcher, 0 forks, and 0 stars. The 'Code' tab is selected, showing the 'main' branch. A recent commit by 'maglet' is visible, titled 'Update README.md'. The README file is displayed, showing the title 'github-gui-demo' and the description 'demo for adding and editing files in GitHub'. The repository description on the right also reads 'demo for adding and editing files in GitHub'. The text 'Repo description' is written in red below the repository description.

maglet / [github-gui-demo](#) Public

Pin Unwatch 1 Fork 0 Star 0

<> Code Issues Pull requests Actions Projects Wiki Security ...

main Go to file Add file <> Code About

maglet Update README.md now 7

README.... Update README.md now

README.md

github-gui-demo

demo for adding and editing files in GitHub

Readme 0 stars 1 watching 0 forks

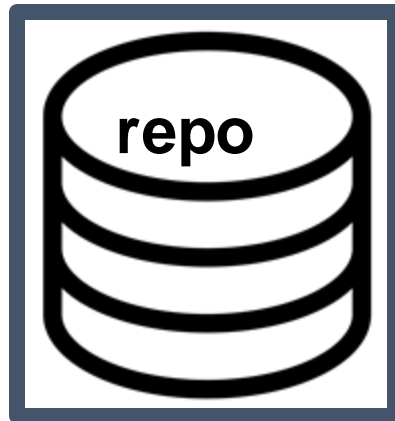
Repo description

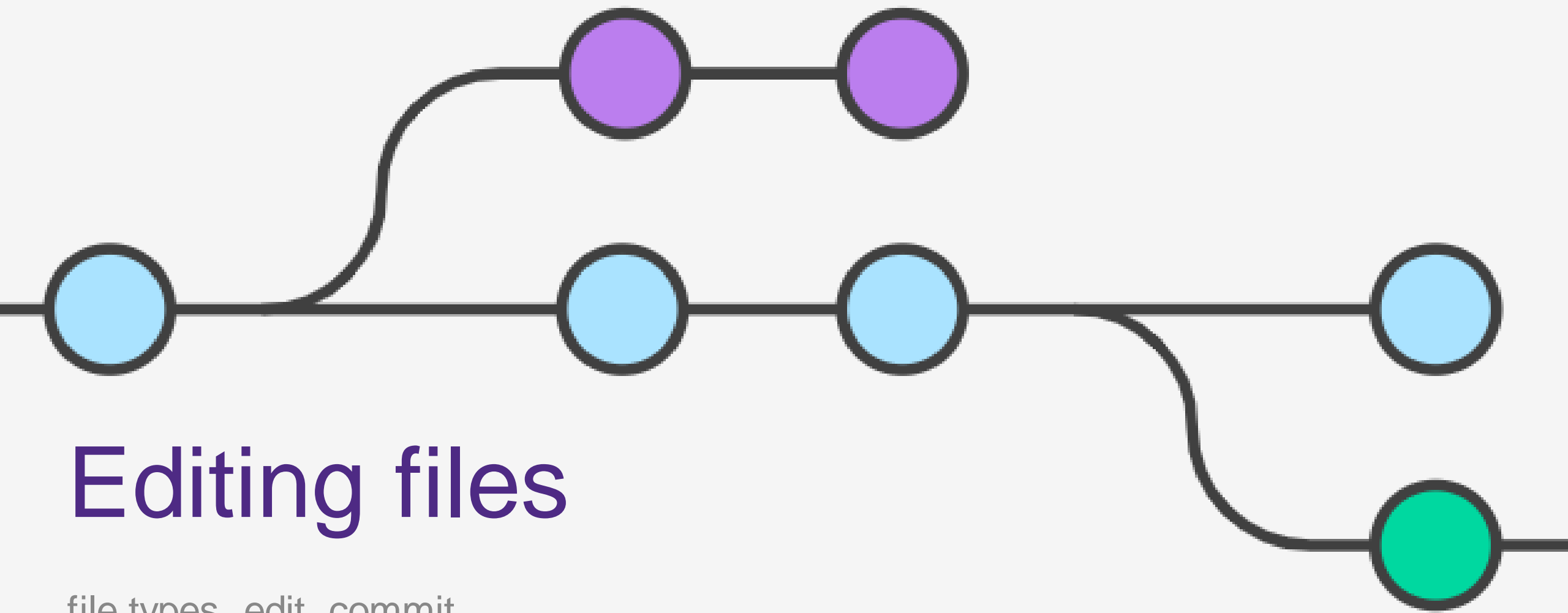
What we've done so far

File



GitHub





Editing files

file types, edit, commit

Types of files git works best with

“Good” formats (text based)

- Documents (.txt, .tex, .rtf, .md)
- Tabular Data (.csv)
- Source code (.R, .py, .c, .sh)

“Bad” formats (binary files)

- Documents (.docx, .pdf, .ppt)
- Excel spreadsheets (.xlsx)
- Media (.jpg, .mp3, .mp4)
- Databases (.mdb, .sqlite)

Edit the README file

The screenshot shows the GitHub interface for the repository 'maglet / github-gui-demo'. The repository is public. The navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, and Security. Below the navigation bar, there are buttons for 'main', 'Go to file', 'Add file', and 'Code'. A commit history section shows a recent commit by 'maglet' titled 'changed readme again' at 'now' with a clock icon and the number '5'. Below this, the README file is displayed. The file name 'README.md' is shown, followed by the title 'GitHub GUI demo'. The content of the README file includes the text 'Things to do in the GitHub GUI:' followed by a bulleted list: 'Edit files', 'Add files', and 'Look at changes'. In the top right corner of the README file view, there is a red 'Edit' button with a pencil icon, which is highlighted by a red square.

maglet / github-gui-demo Public

Pin Unwatch 1

<> Code Issues Pull requests Actions Projects Wiki Sec

main Go to file Add file <> Code

maglet changed readme again ... now 5

README.md changed readme again now

README.md Edit

GitHub GUI demo

Things to do in the GitHub GUI:

- Edit files
- Add files
- Look at changes

File editor

 **maglet / github-gui-demo** Public


 Pin


 Unwatch **1** ▼

 Fork **0** ▼

 Star **0** ▼

 **Code**

 Issues

 Pull requests

 Actions

 Projects

 Wiki

 Security

 Insights

...

Change name

github-gui-demo / in main

Cancel changes

 **Edit file**

 Preview

Spaces ▼

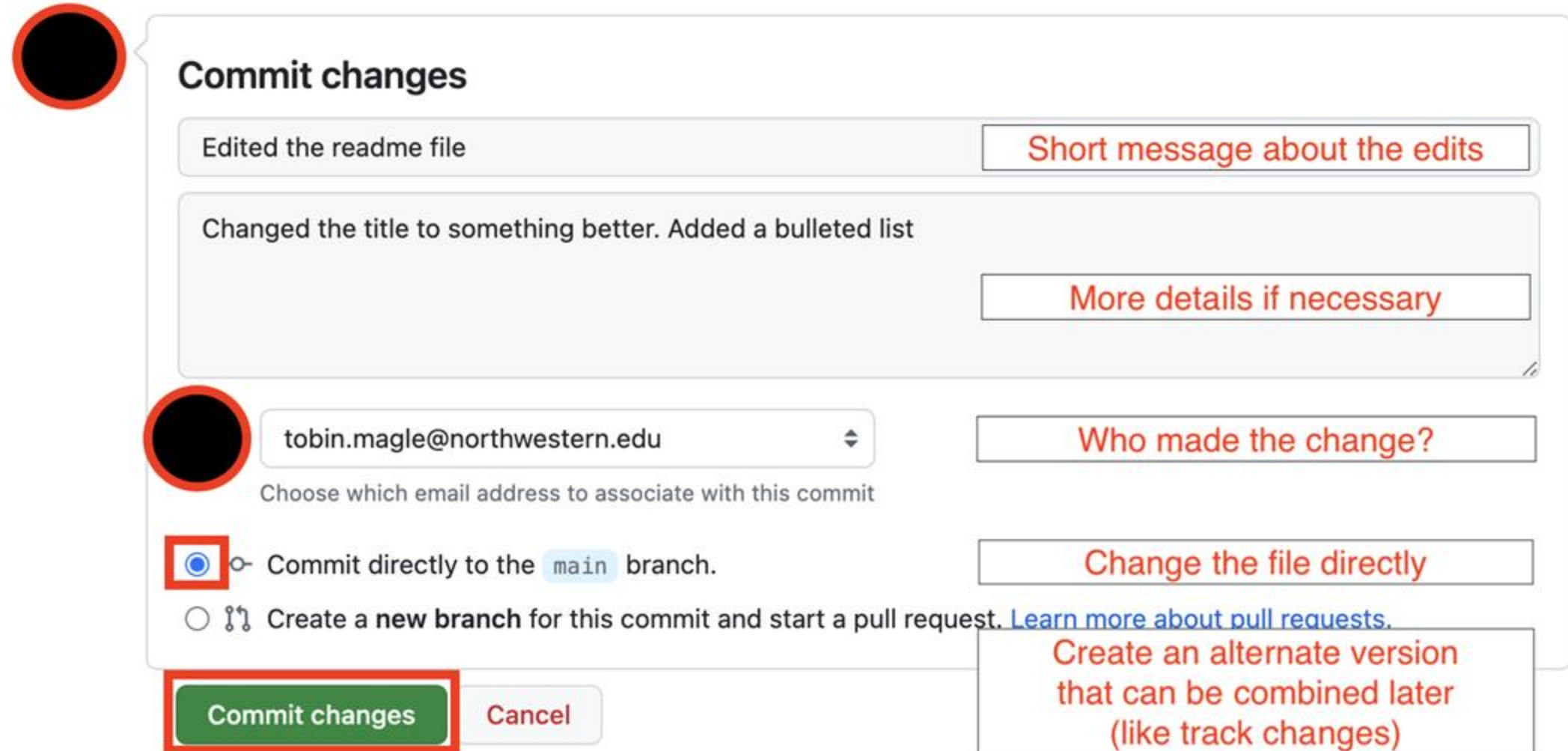
2 ▼

Soft wrap ▼

```
1 # github-gui-demo
2
3 demo for adding and editing files in GitHub
4
```

Edit text

Commit Changes



Commit changes

Edited the readme file

Short message about the edits

Changed the title to something better. Added a bulleted list

More details if necessary

tobin.magle@northwestern.edu

Choose which email address to associate with this commit

☒ Commit directly to the `main` branch.

☐ Create a new branch for this commit and start a pull request. [Learn more about pull requests.](#)

Who made the change?

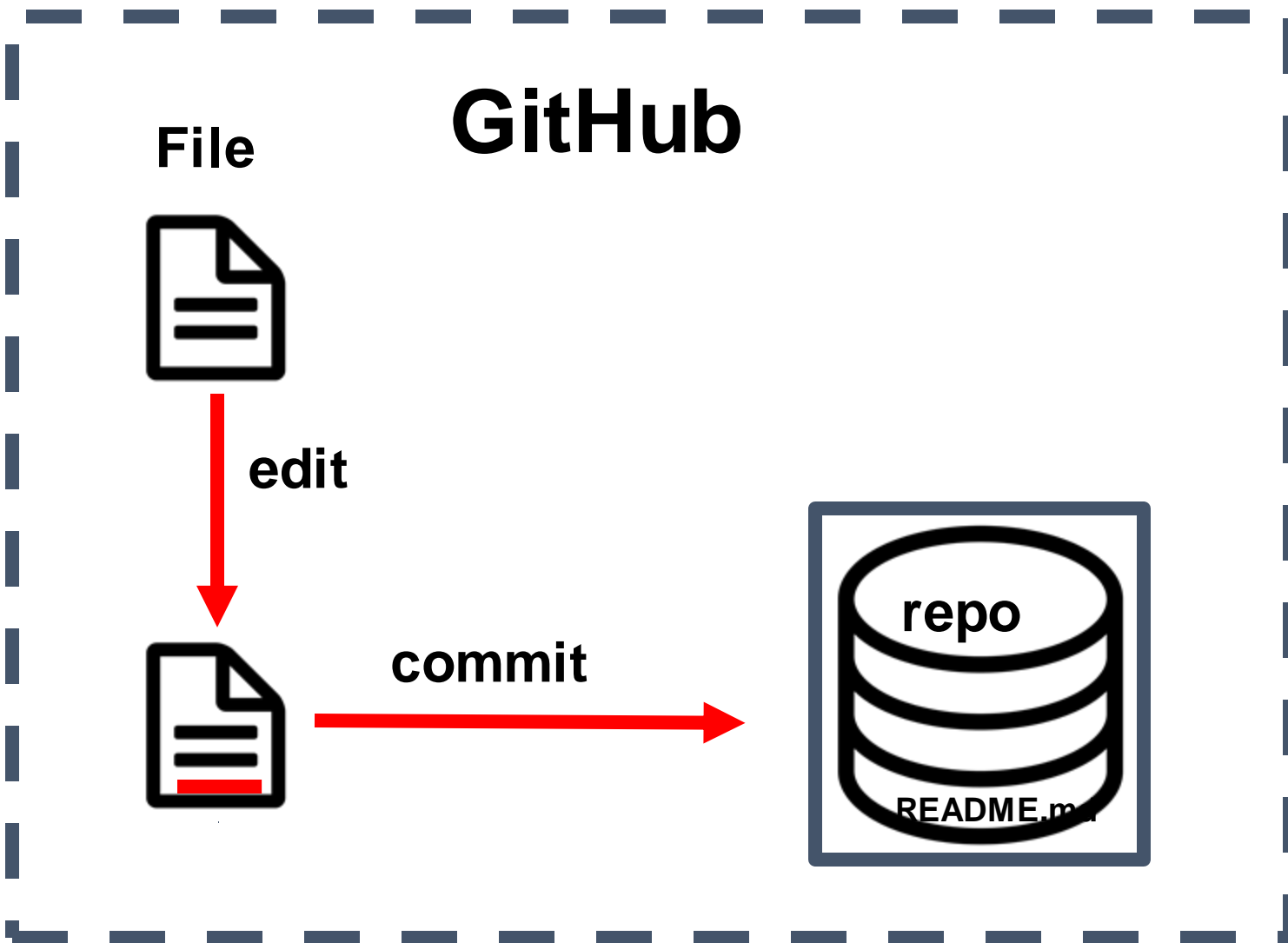
Change the file directly

Create an alternate version that can be combined later (like track changes)

Commit changes Cancel

The image shows a GitHub commit interface. A red circle highlights the 'Commit changes' header. Another red circle highlights the email address dropdown menu. A red box highlights the 'Commit directly to the main branch' radio button. A third red box highlights the 'Commit changes' button at the bottom left. Red text boxes provide additional context: 'Short message about the edits' points to the commit message input area, 'More details if necessary' points to the description input area, 'Who made the change?' points to the email address dropdown, 'Change the file directly' points to the 'Commit directly to the main branch' option, and 'Create an alternate version that can be combined later (like track changes)' points to the 'Create a new branch' option.

What we've done so far













Blame, history, diff

Blame

See when each line of a file was edited last

github-gui-demo / README.md 


Newer ||||| Older



 100644	6 lines (5 sloc)	111 Bytes		Raw	Normal view	History
 Edited the readme file	43 minutes ago		1	# Demo repository for using the GitHub GUI		
 Update README.md	yesterday		2			
 Edited the readme file	43 minutes ago		3	Things to do		
			4	* add a file		
			5	* edit a file		
			6	* look at what has changed		


View History

See all commits that have been made

Beta [Try the new code view](#)

 main ▾ [github-gui-demo](#) / README.md Go to file ...

 **maglet** Edited the readme file ... Latest commit e1b19cd 33 minutes ago  **History**

 1 contributor

View History

History for [github-gui-demo](#) / README.md

Commits on May 8, 2023

Added collab things to do to readme



aGitHasNoName committed 10 hours ago

Verified



[ec63244](#)



Commits on Apr 21, 2023

Edited the readme file ...



maglet committed 2 weeks ago

Verified



[e1b19cd](#)



Update README.md



maglet committed 2 weeks ago

Verified



[20225f0](#)



Update README.md



maglet committed 2 weeks ago

Verified



[596c419](#)



changed readme again



maglet committed 2 weeks ago

Verified



[dcd9cb8](#)



Update README.md ...



maglet committed 2 weeks ago

Verified




[c42588e](#)







View History

See who made the commit, when, and the commit message

History for [github-gui-demo](#) / README.md

 Commits on Apr 21, 2023

	Commit message		Commit ID	
who	 maglet	Edited the readme file ...	Verified	 e1b19cd  
	committed 34 minutes ago	When		

diff


See what changed in the file line by line

Edited the readme file



Changed the title to something better. Added a bulleted list

[Browse files](#)

main

 maglet committed 38 minutes ago Verified 1 parent [20225f0](#) commit [e1b19cd](#)

Showing 1 changed file with 5 additions and 2 deletions. Split Unified

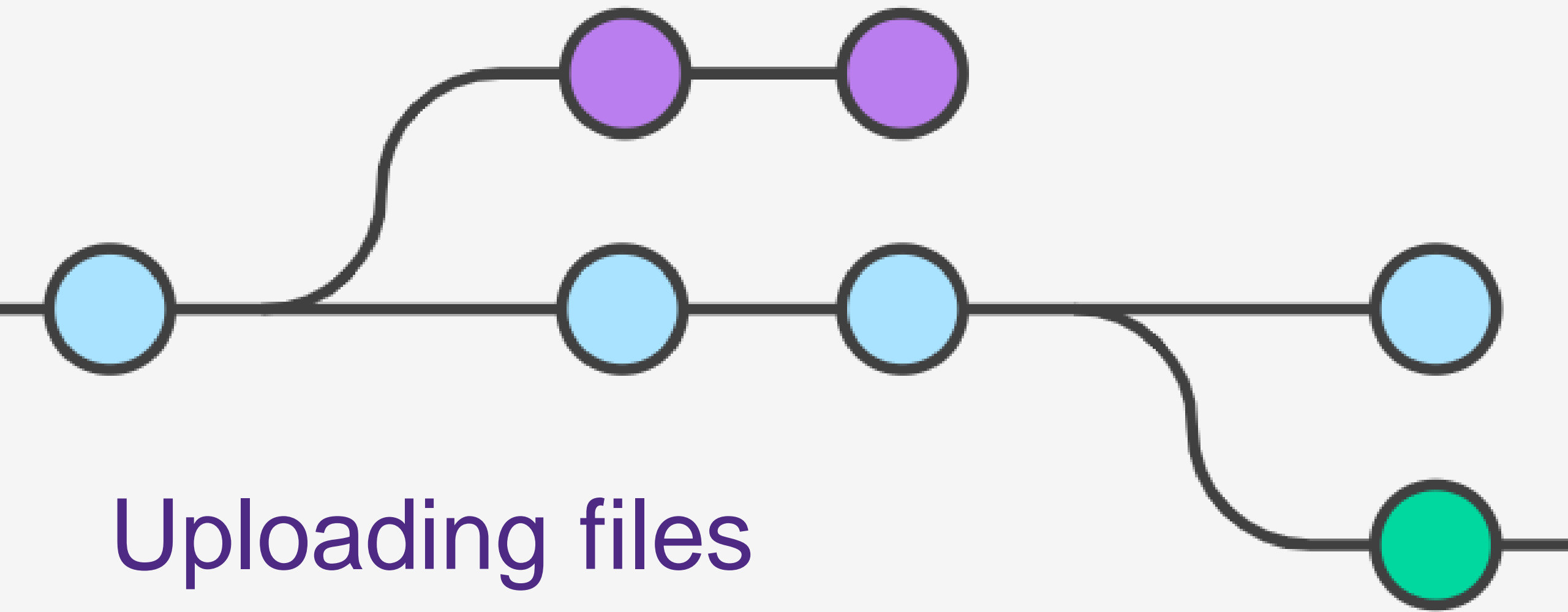
7  README.md 

... @@ -1,3 +1,6 @@

1 - # github-gui-demo	1 + # Demo repository for using the GitHub GUI
2	2
3 - demo for adding and editing files in GitHub	3 + Things to do
	4 + * add a file
	5 + * edit a file
	6 + * look at what has changed

Red = deleted

Green = added



Add a file from your computer

The screenshot shows the GitHub interface for the repository 'maglet / github-gui-demo', which is public. The top navigation bar includes links for 'Code', 'Issues', 'Pull requests', 'Actions', 'Projects', 'Wiki', and a shield icon. Below this, the 'main' branch is selected. A red circle highlights the 'Add file' button, which has opened a dropdown menu with two options: 'Create new file' and 'Upload files'. The 'Upload files' option is highlighted in blue. In the background, a commit by 'maglet' is visible, showing a change to 'README.md' made '50 minutes ago'.

maglet / github-gui-demo Public

Pin Unwatch 1

<> Code Issues Pull requests Actions Projects Wiki

main

Go to file Add file

Create new file

Upload files

maglet Edited the readme file ...

tes ago 8

README.md Edited the readme file 50 minutes ago

Choose files

github-gui-demo /



Drag files here to add them to your repository

Or [choose your files](#)

Commit



Commit changes

Added an R script

Add an optional extended description...

- ☒ Commit directly to the `main` branch.
- ☐ Create a **new branch** for this commit and start a pull request. [Learn more about pull requests.](#)

Commit changes

Cancel

File was added

 main ▼

Go to file

Add file ▼

 Code ▼



maglet Added an R script ...

now  9



README.md

Edited the readme file

1 hour ago

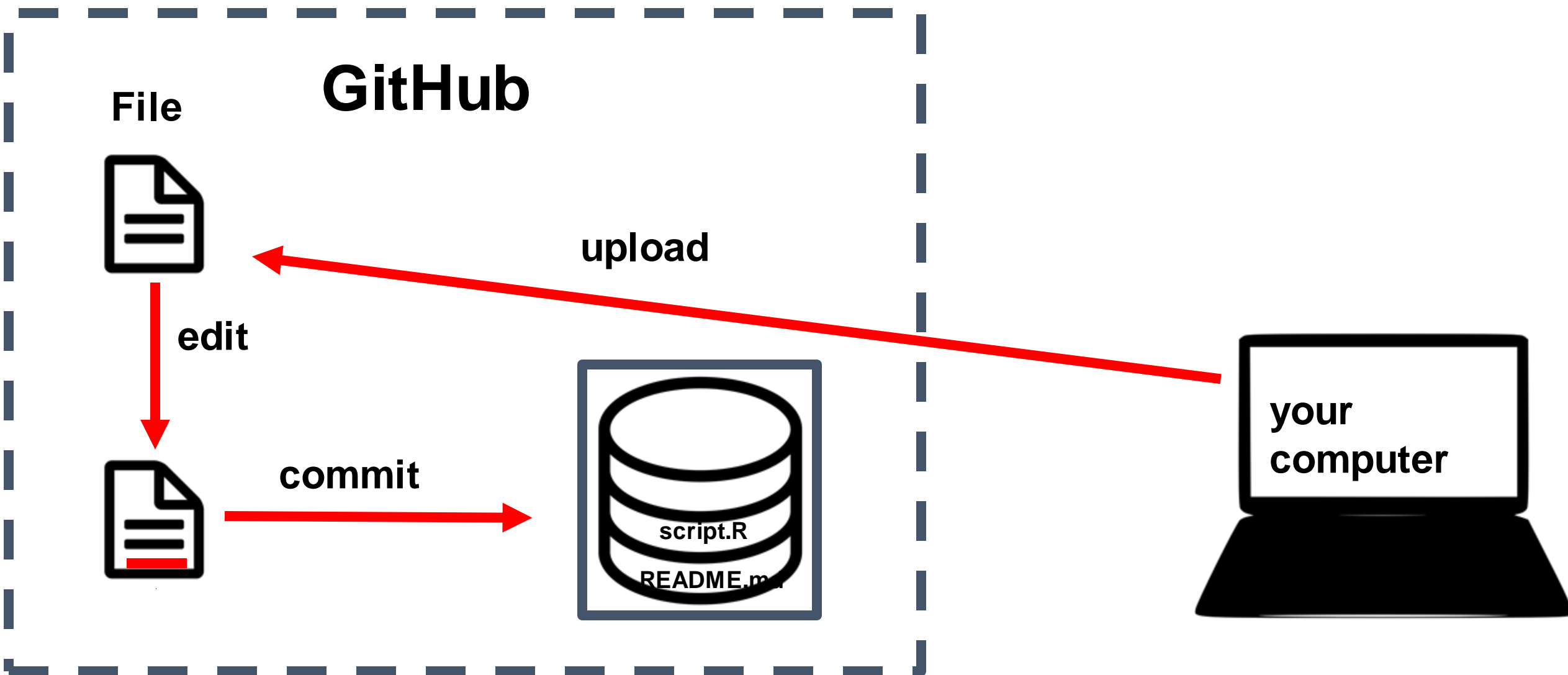


script.R

Added an R script

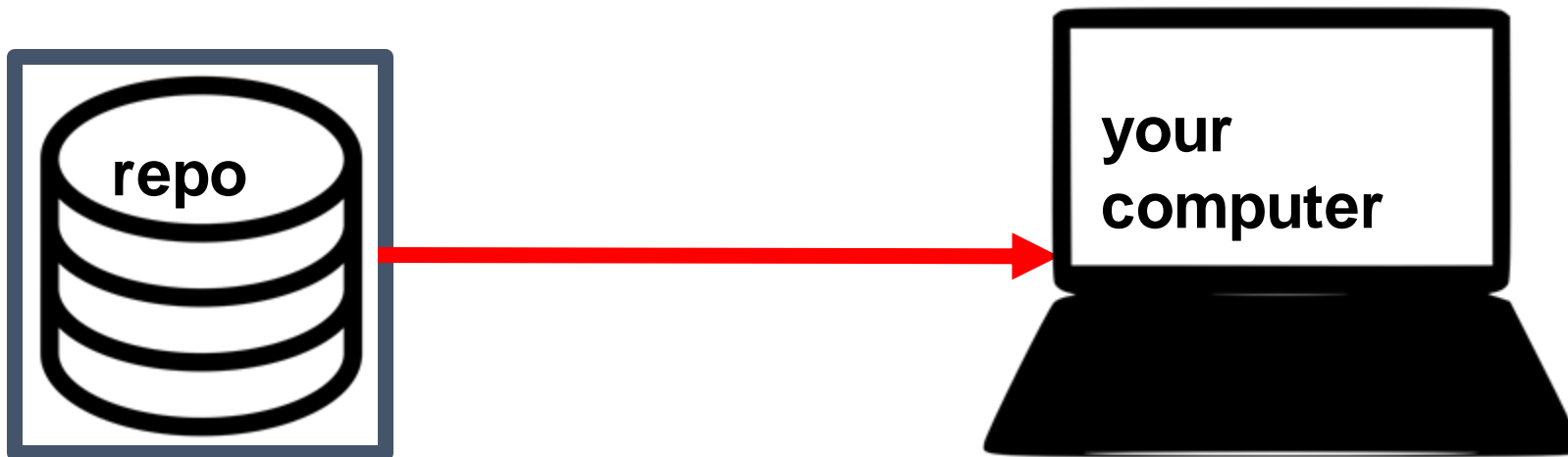
now

What we've done so far



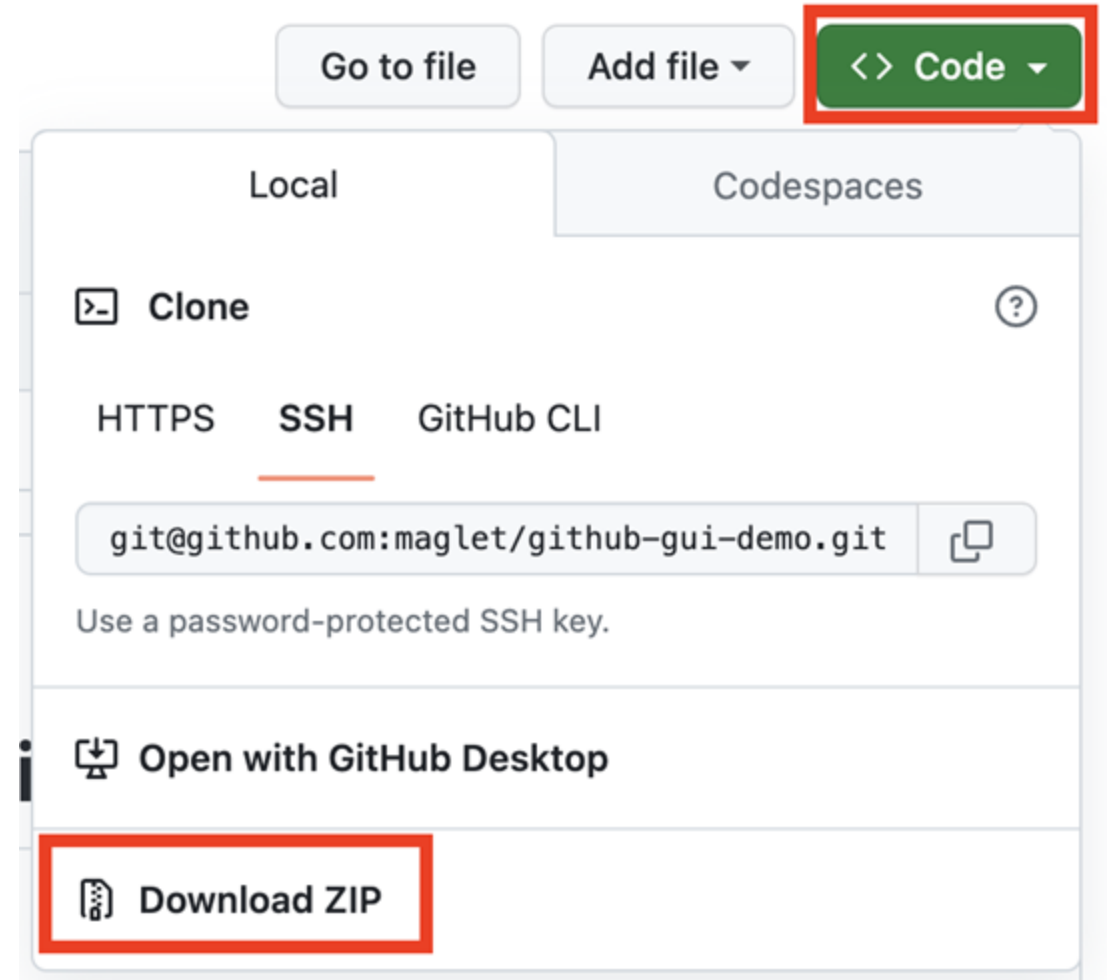
Running code

- **Copy and paste** - take the lines of code you need to run locally
- **Download** - download most recent version of files
- **Clone** - downloads the whole repository to do version control on your computer



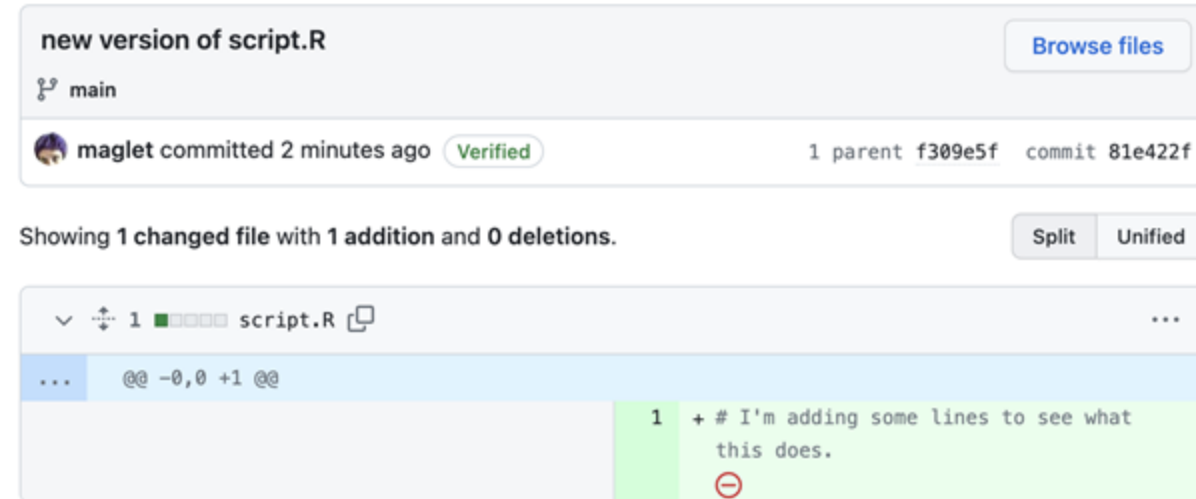
Download

- Click the green code button
- Click download ZIP
- Extract files using a program on your computer
- Open your files

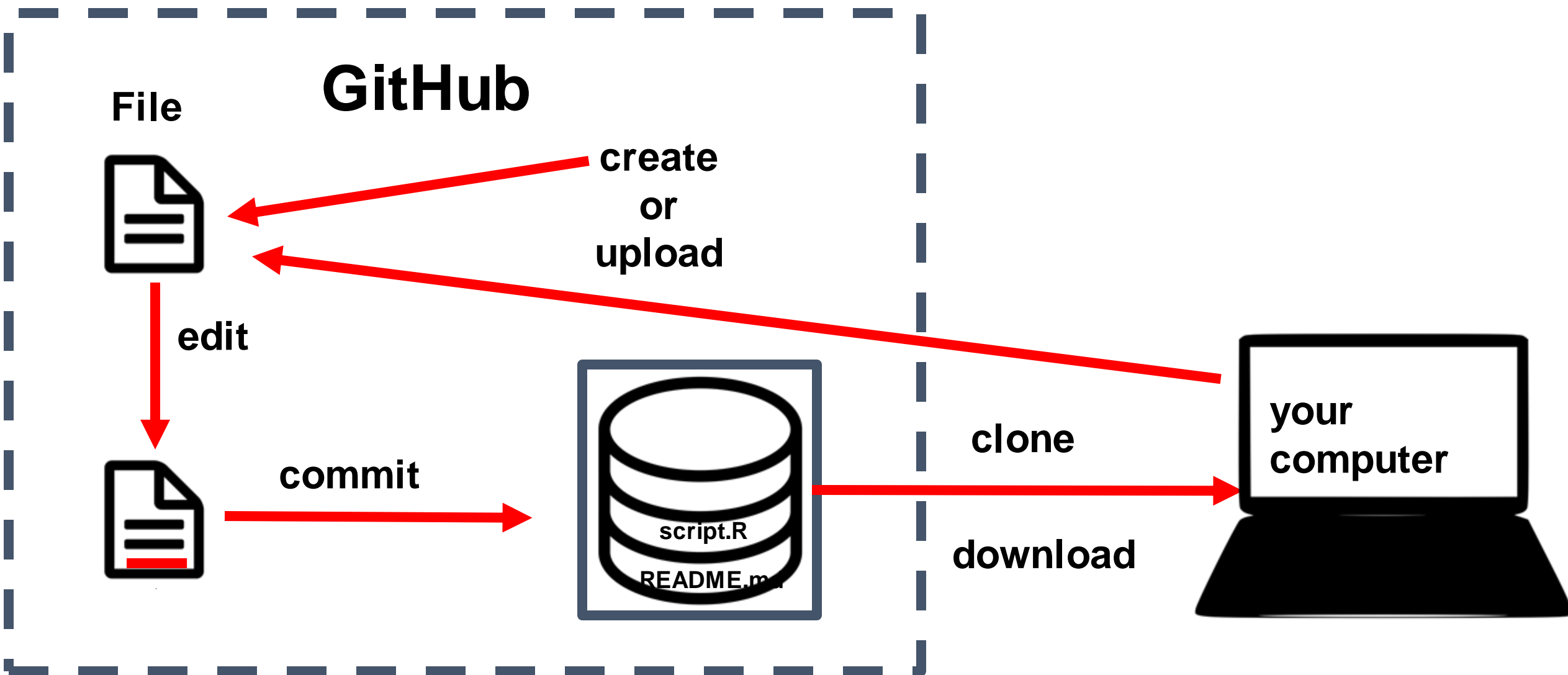


Save changes

- Add file > upload file
- Select the file you changed
- Commit with a message
- File is updated



GitHub workflow overview



A graphic featuring several thick, colorful ribbons (purple, yellow, black, blue, green, red) that cross and braid together on a grey background. The word "Collaboration" is written in white, centered over the braided section of the ribbons.

Collaboration

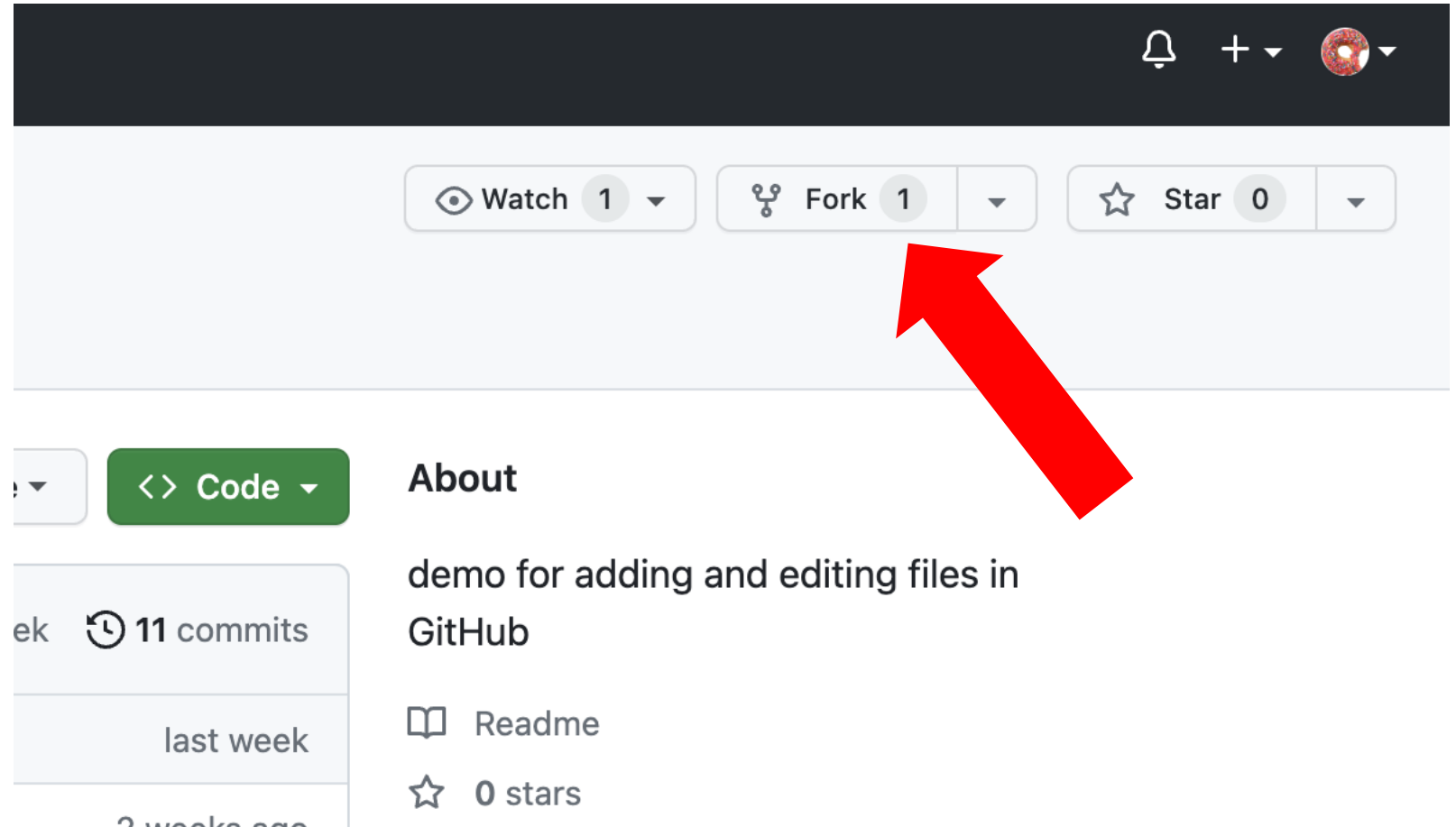
SO MUCH
JARGON with Git



STEP ONE: **FORK** THE REPO

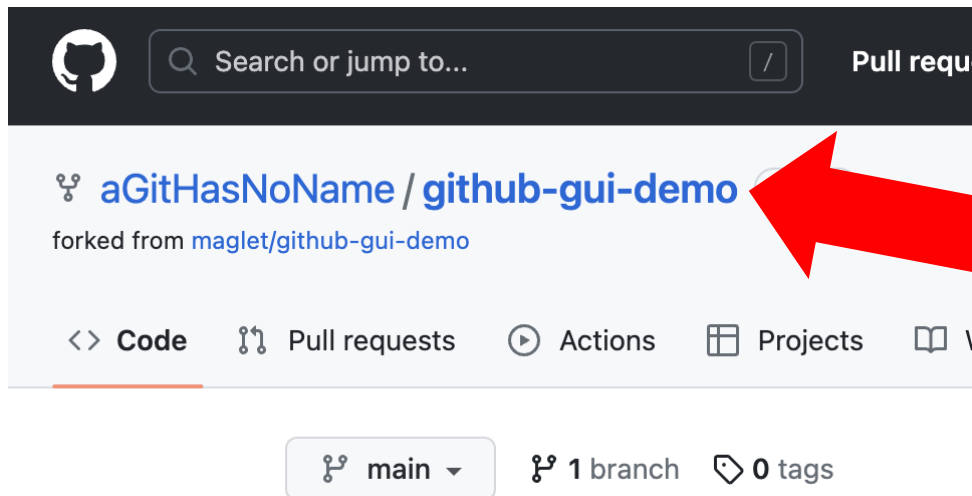
Fork your friend's repo (AKA make a copy of the repo in your own account).

You can now play around with your version without messing up your friend's.

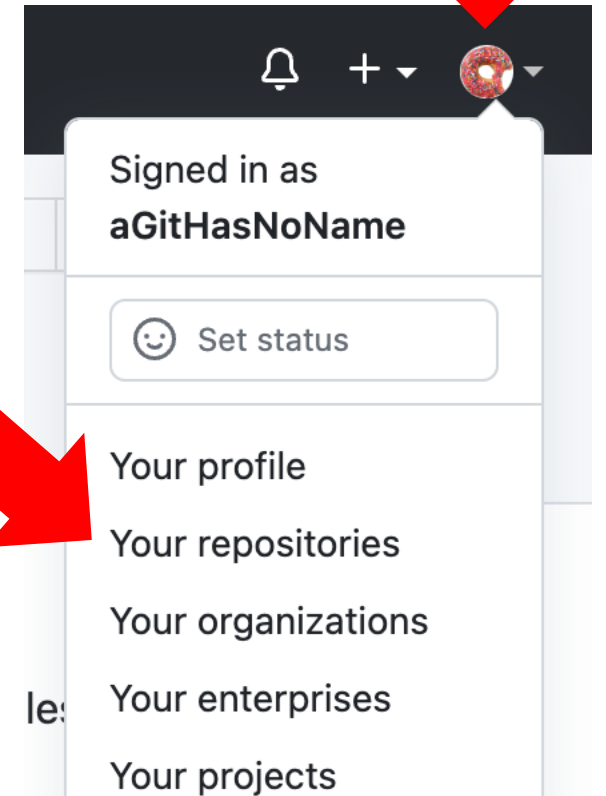


STEP TWO: **OPEN** your version of the repo

Click on your account in the top right corner of your screen. Then click on Your repositories. Choose the forked repo.



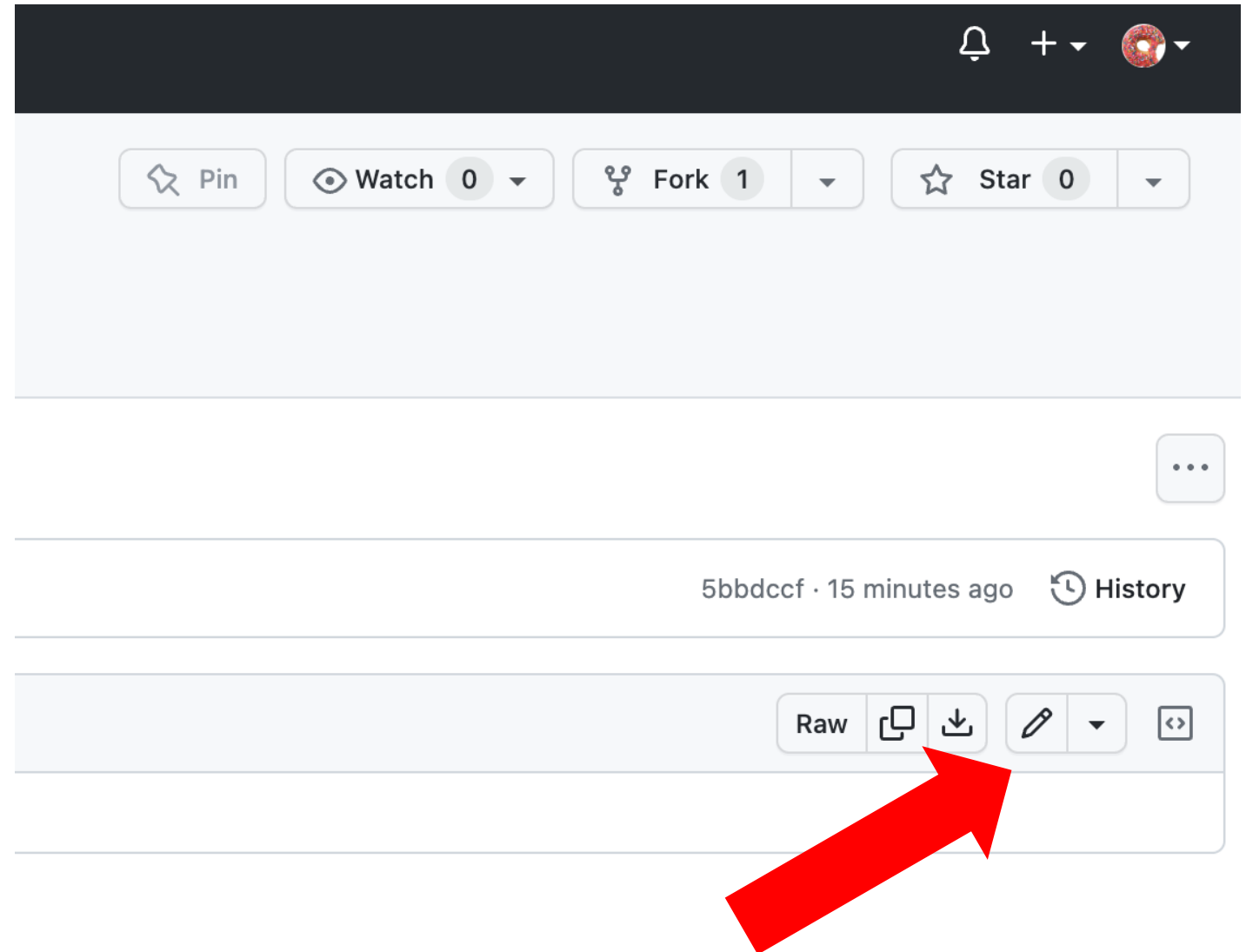
You can see it's your version of the repo in the top left of your screen.



STEP THREE: **EDIT** a file

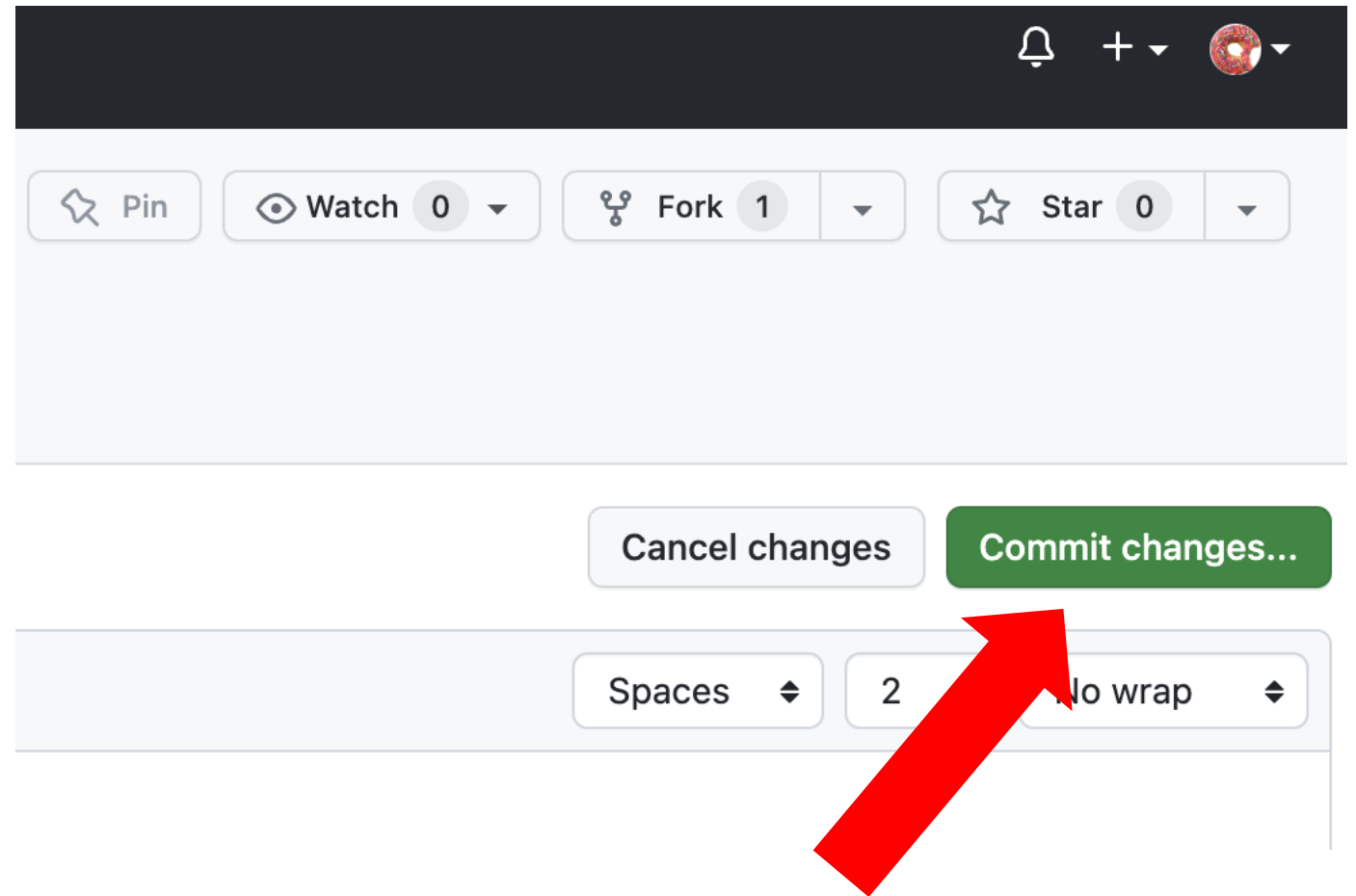
Open a file in the repo. Click on the pencil icon to Edit the file.

You can make direct changes or paste in new code you've been working on.



STEP FOUR (a): **COMMIT** your changes

The button will light up once you've made a change to the file.



STEP FOUR (b): COMMIT your changes

Name your commit.

You can commit directly to the **main branch** (that's the main branch in YOUR version of the repo). This lets you keep working on this file or on other files too before sending all your changes to your friend.



Commit changes

Commit message

Update script.R

Extended description

Add an optional extended description..

Commit Email

colbywitherup@gmail.com

☒ Commit directly to the main branch

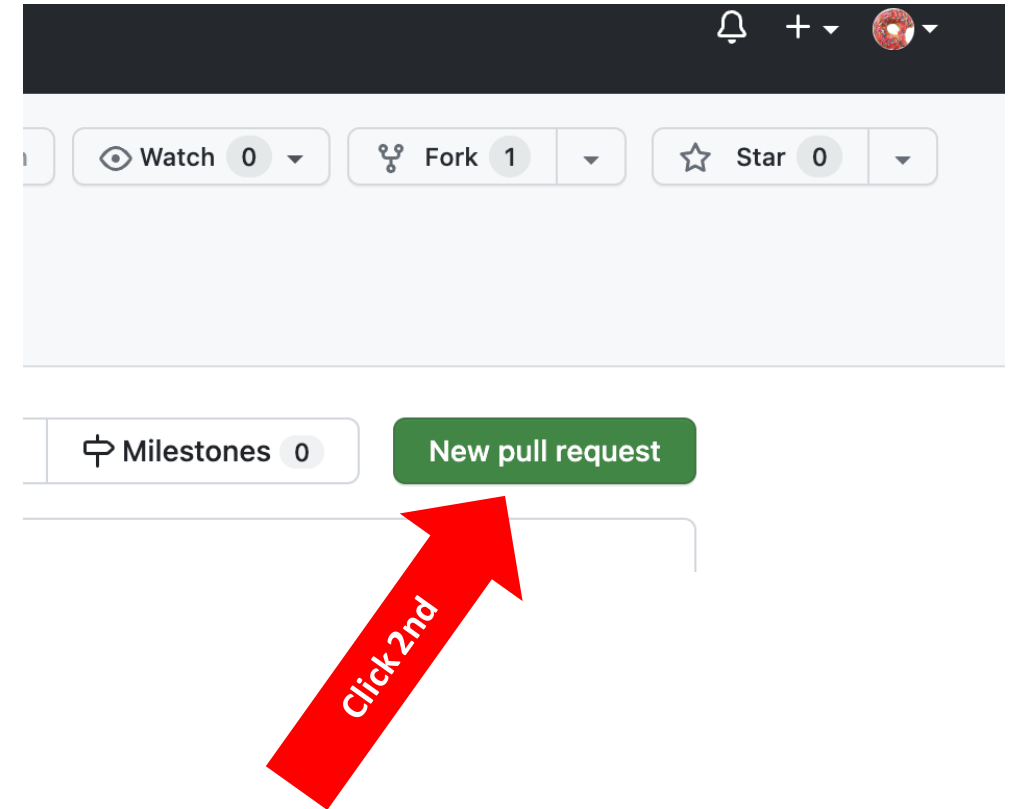
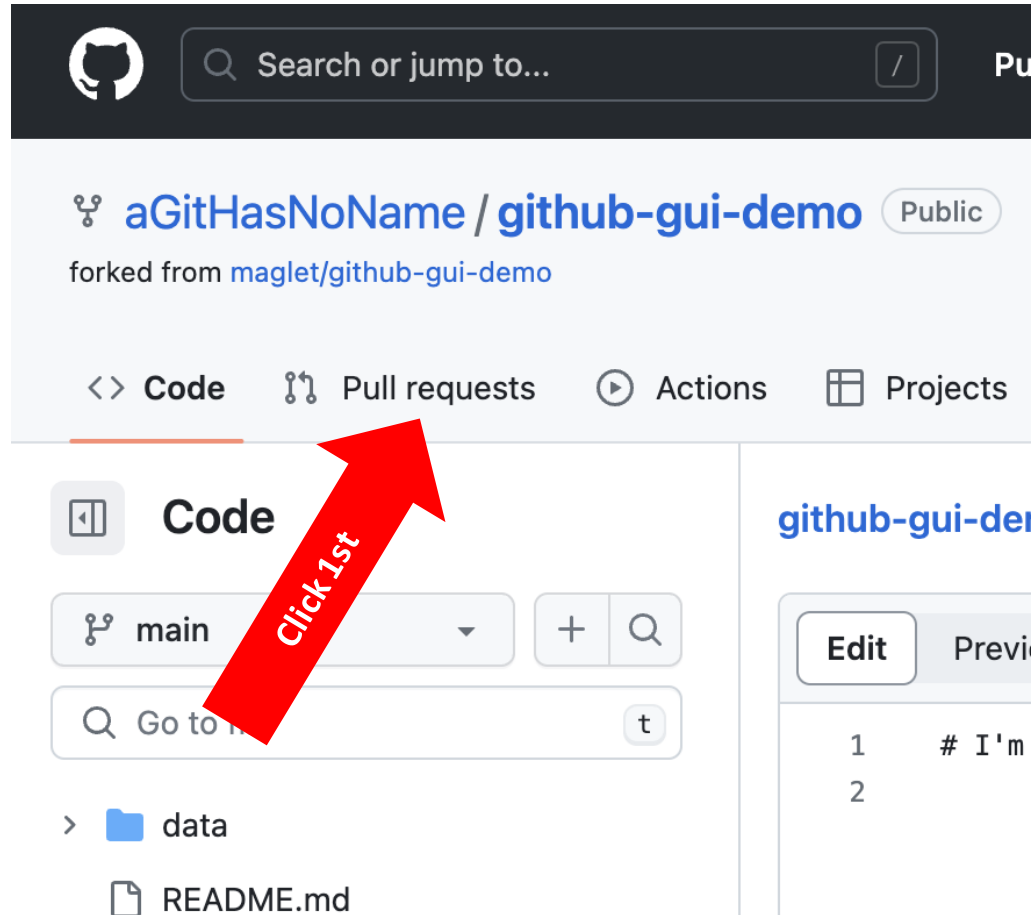
☐ Create a new branch for this commit and start a pull request

[Learn more about pull requests](#)

Cancel

Commit changes

STEP FIVE (a): Create a **PULL** request



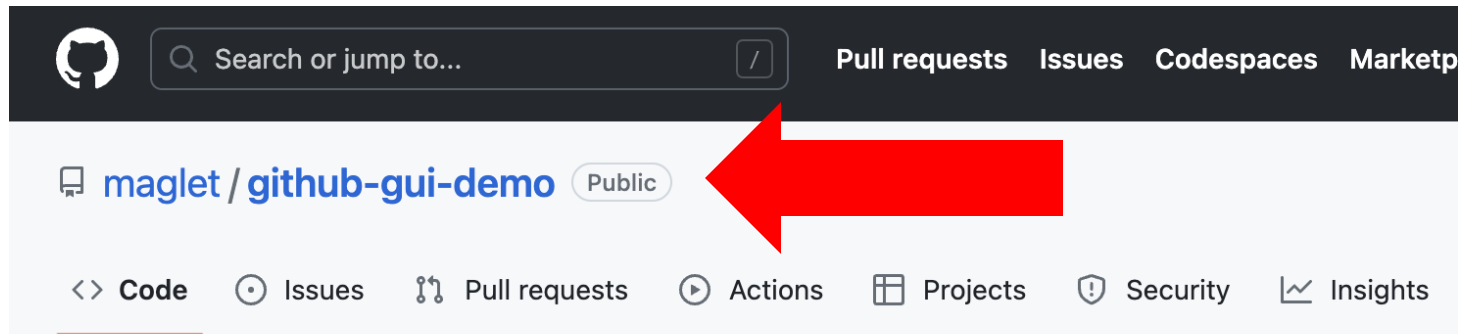
PUSH

- AKA “**Create a pull request**” when working with someone else’s repo
- Make changes (AKA **commits**) to your version of the repo and ask them to accept those changes into their version of the repo
- *Remember, your friend won’t lose their previous version if they accept your changes – all versions are saved!*

PULL

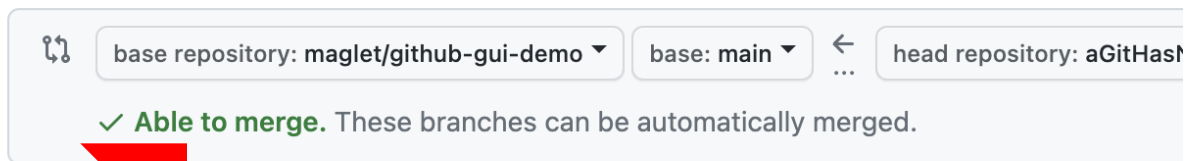
- Like “Accept all changes” in Microsoft Word when you let someone else review and make suggestions to your doc

STEP FIVE (b): Create a **PULL** request



Comparing changes

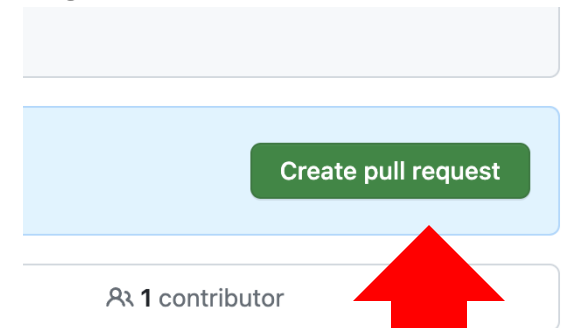
Choose two branches to see what's changed or to start a new pull request. If you need to, you



If it doesn't say "Able to merge", that means your friend has made changes since the last time you merged. Jump ahead to Step Five (d) for help.

It will now list your friend's version of the repo.

If it says "Able to merge", click the green button.



STEP FIVE (c): Create a **PULL** request

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 repository: maglet/github-gui-demo ▾


base: main ▾

...

head repository: aGitHasNoName/github-gui-... ▾

compare: main ▾

✓ **Able to merge.** These branches can be automatically merged.



Added to readme

Write

Preview

H B I ≡ <> 🔗 ≡ ≡ ≡ @ 🗨️ ↩️ 📄

Leave a comment

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

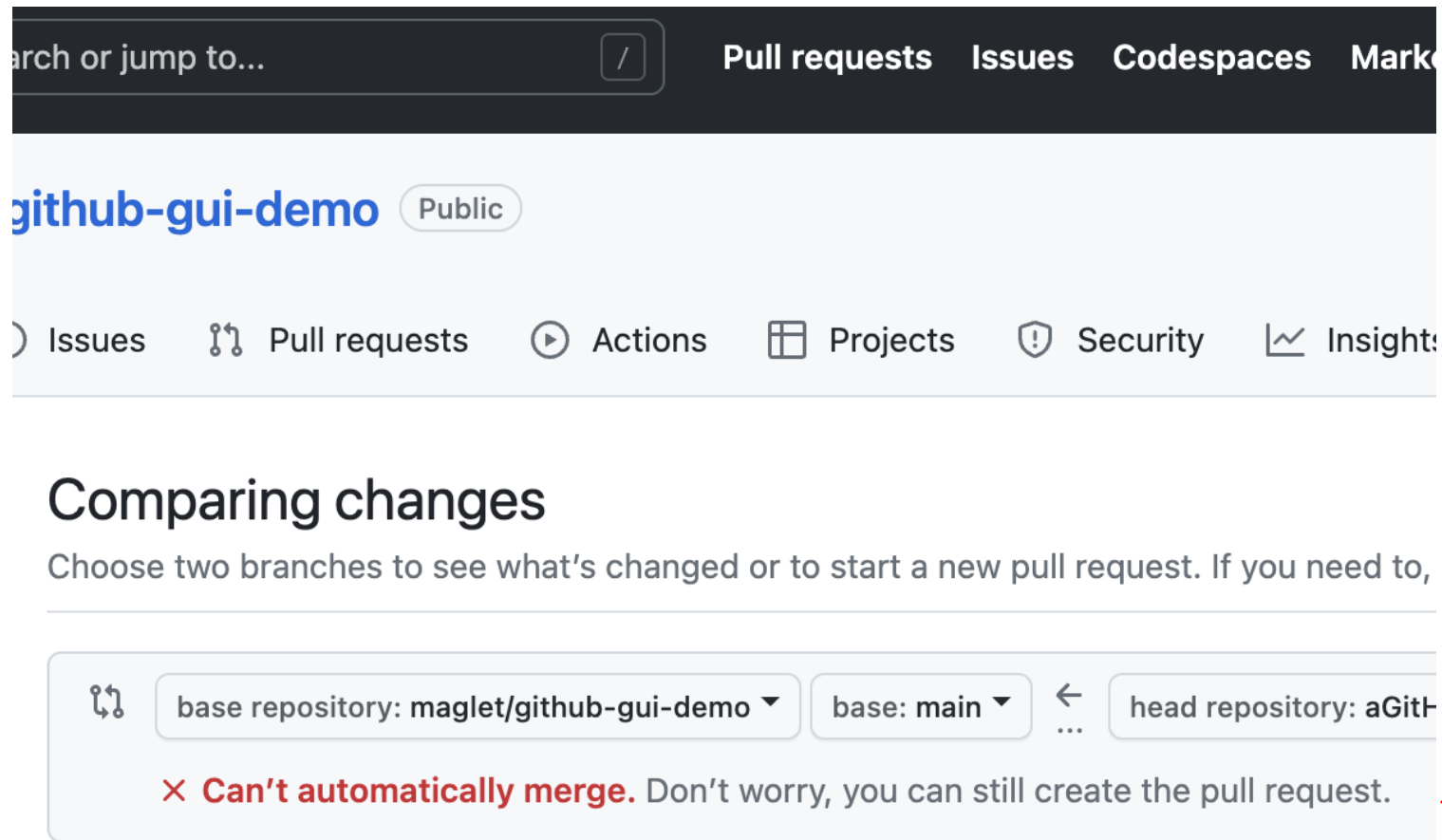
☒ Allow edits by maintainers ?

Create pull request ▾

Give the pull request a name. You can also write a comment to your friend.

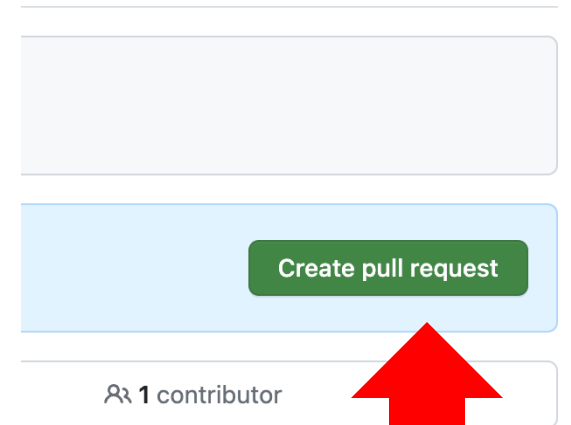
Click the green button.

STEP FIVE (d): **HELP!** Can't automatically merge

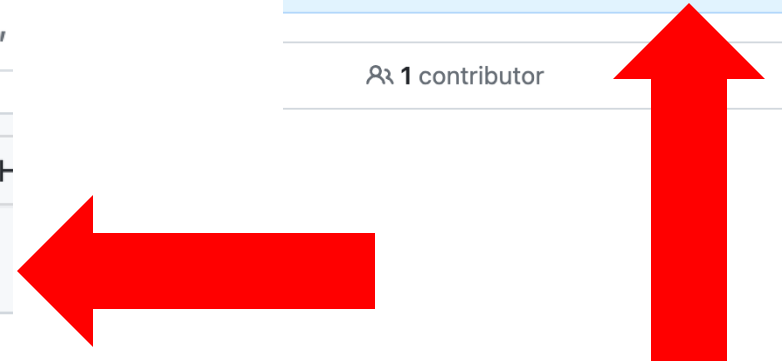


The screenshot shows the GitHub interface for the repository 'maglet/github-gui-demo'. The page title is 'Comparing changes'. Below the title, it says 'Choose two branches to see what's changed or to start a new pull request. If you need to,'. The comparison is set up with 'base repository: maglet/github-gui-demo' and 'base: main' as the base, and 'head repository: aGith-' as the head. A red error message at the bottom states: '× Can't automatically merge. Don't worry, you can still create the pull request.'

Click the green button anyway.



This block is a close-up of the 'Create pull request' button, which is green and located on the right side of the page. Below the button, it says '1 contributor'.



STEP FIVE (d): **HELP!** Can't automatically merge

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 repository: maglet/github-gui-demo

base: main

head repository: aGitHasNoName/github-gui-...

compare: main

✗ **Can't automatically merge.** Don't worry, you can still create the pull request.

removed Has

Write

Preview

H B I <> @

I think there should be no "Ha"s now.

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

☒ Allow edits by maintainers

Create pull request

Make your case to your friend about why your changes are waaaay better than their changes.

Click the green button.

STEP FIVE (e): **WAIT**

Wait for your friend to accept your pull request.

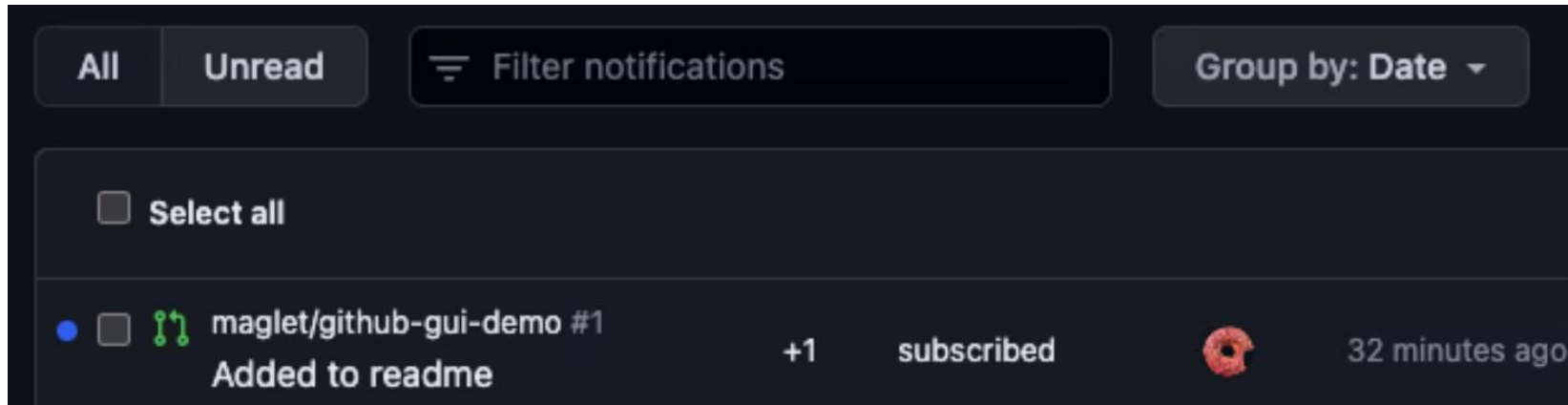
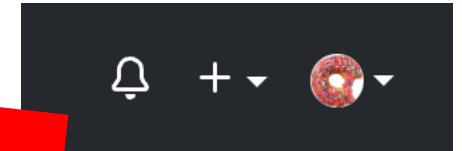
IMPORTANT: If you make any new commits before your friend PULLS, they will go into the same pull request and get pulled along.

How to accept a pull request

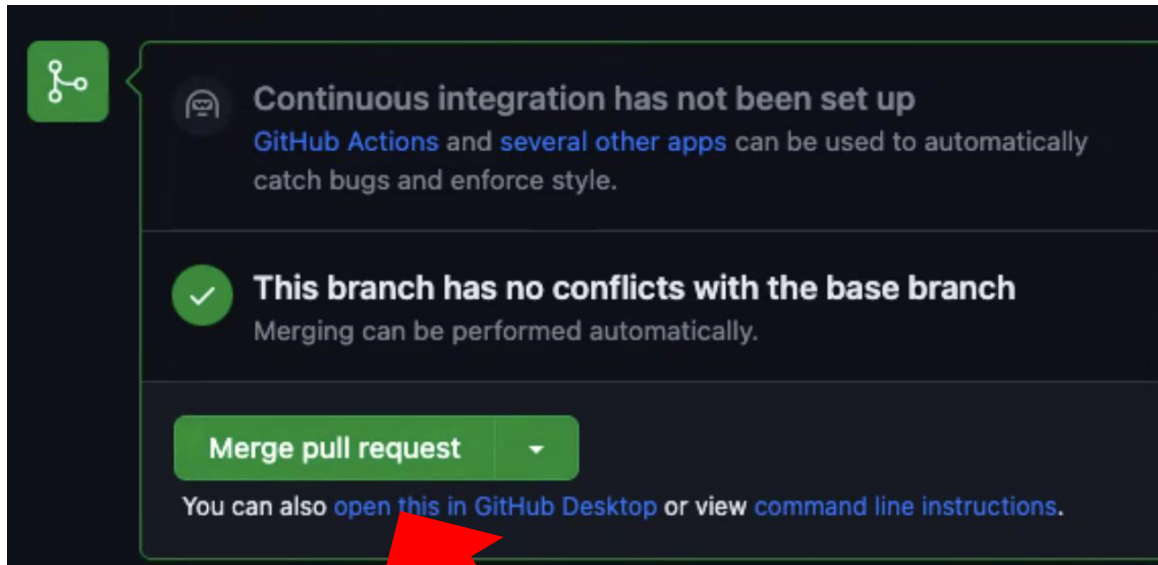
STEP ONE: Open the pull request

Click on your notifications icon in the top right corner.

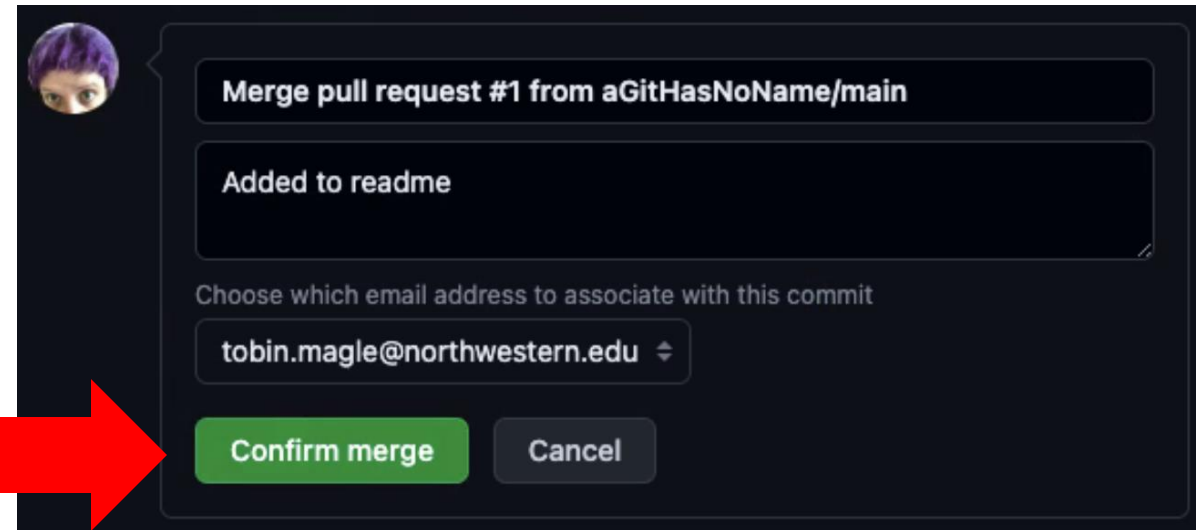
Select the pull request from the menu.



STEP TWO: **MERGE** your friend's changes into your repo



Click on “Merge pull request”,
then “Confirm merge”

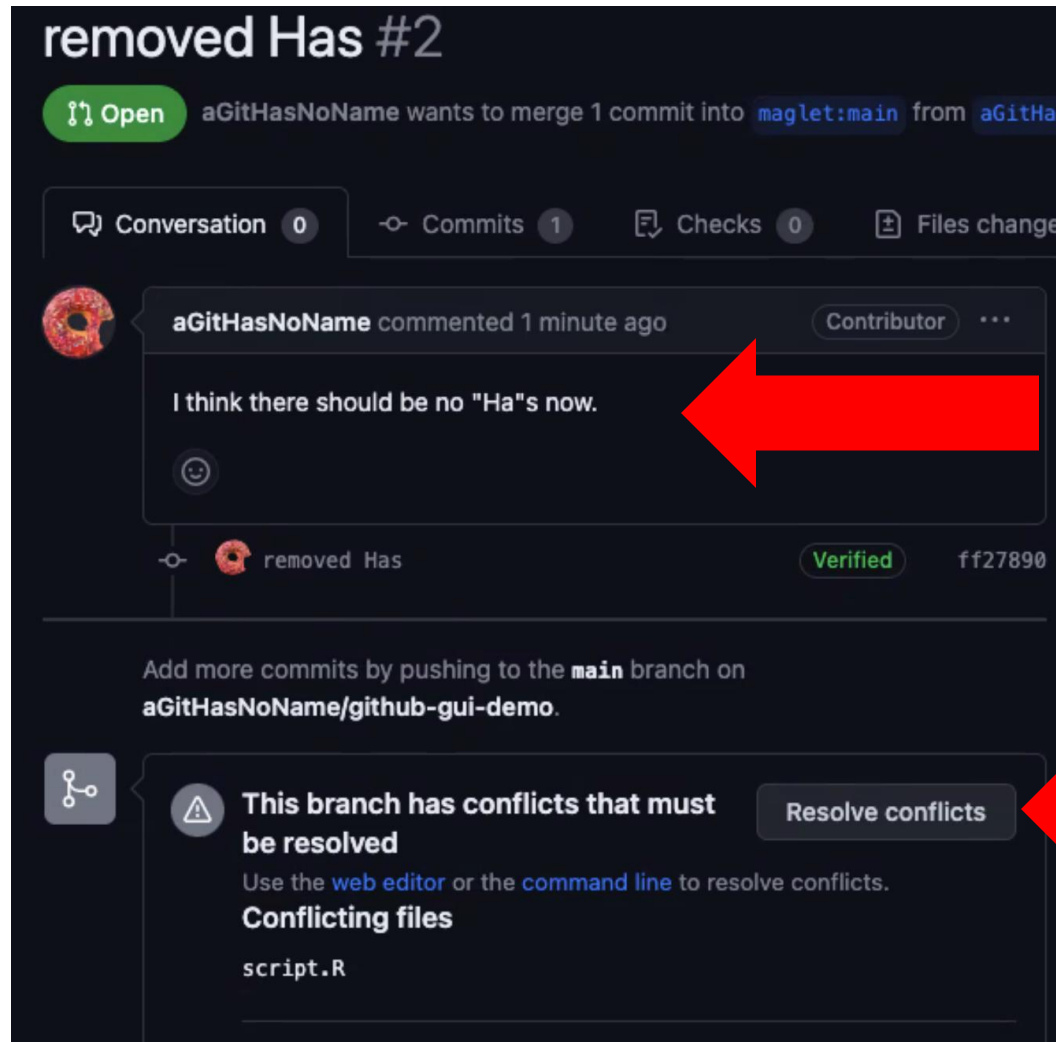


STEP TWO: **MERGE** your friend's changes into your repo



It worked!

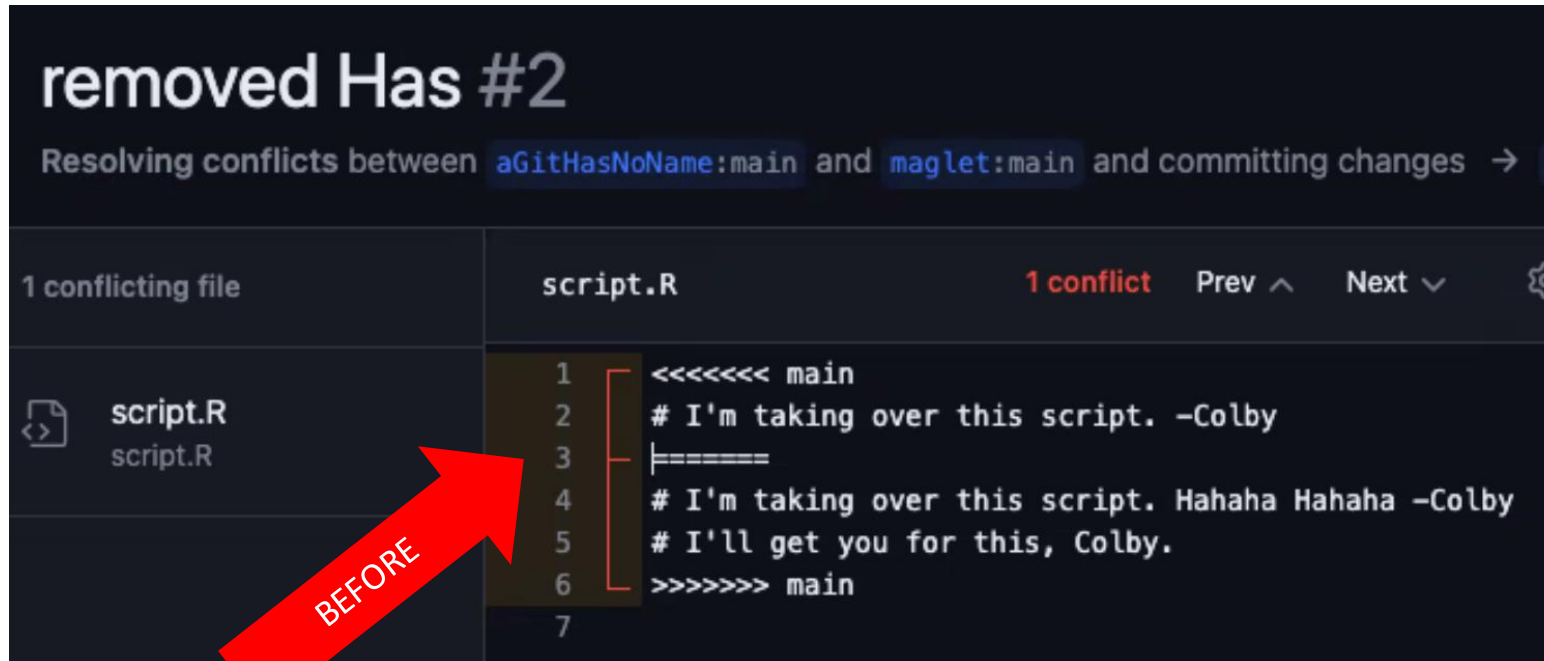
STEP TWO (b): RESOLVE any conflicts



If there's a conflict, you'll see your friend's explanation of their changes.

Click the "Resolve conflicts" button. It's a little hidden.

STEP TWO (b): RESOLVE any conflicts



removed Has #2

Resolving conflicts between `aGitHasNoName:main` and `maglet:main` and committing changes → `a`

1 conflicting file

script.R 1 conflict Prev Next

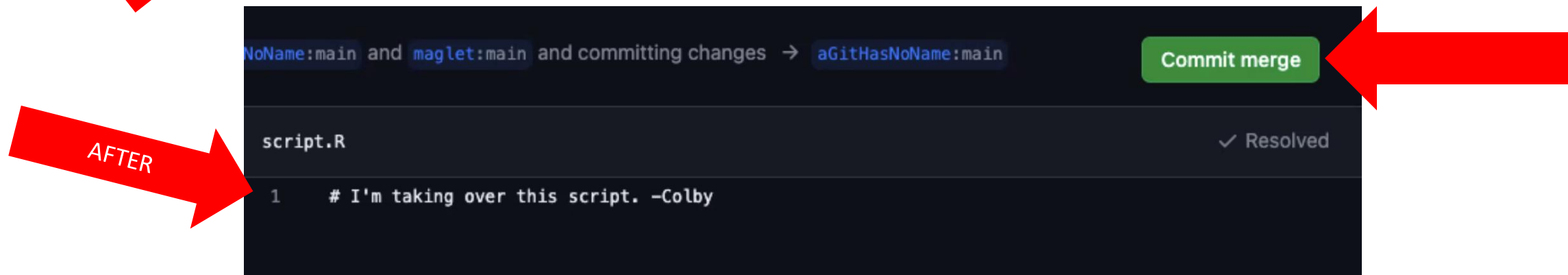
script.R script.R

```
1 <<<<<<< main
2 # I'm taking over this script. -Colby
3 =====
4 # I'm taking over this script. Hahaha Hahaha -Colby
5 # I'll get you for this, Colby.
6 >>>>>> main
7
```

BEFORE

View the conflict.
Decide what it should
really be and edit it
directly in the box.

Once it looks correct,
click the green button.



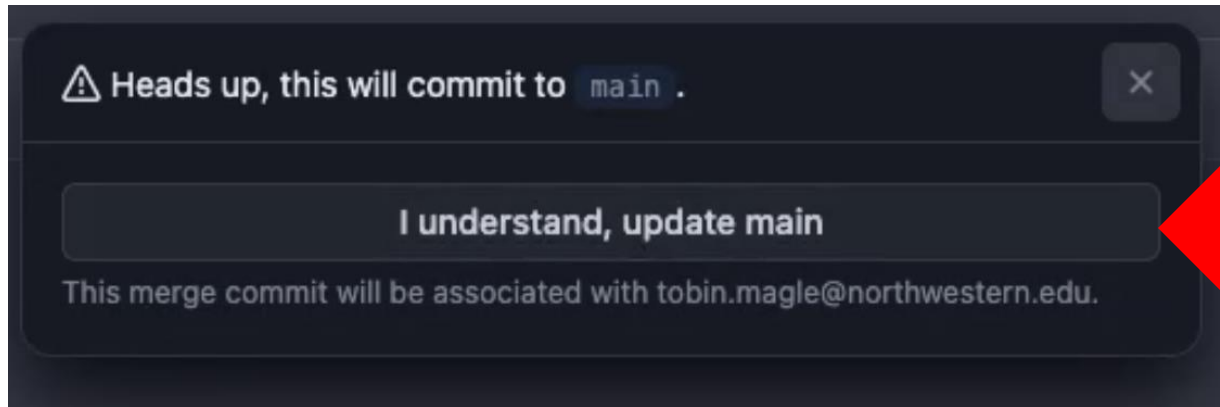
`NoName:main` and `maglet:main` and committing changes → `aGitHasNoName:main` Commit merge

script.R ✓ Resolved

```
1 # I'm taking over this script. -Colby
```

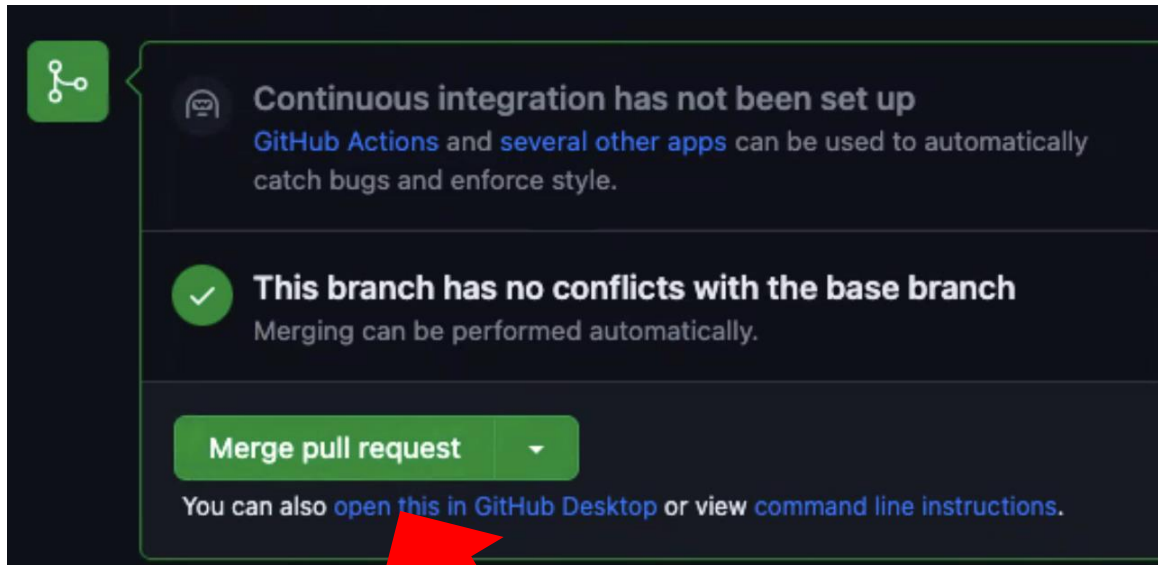
AFTER

STEP TWO (b): RESOLVE any conflicts

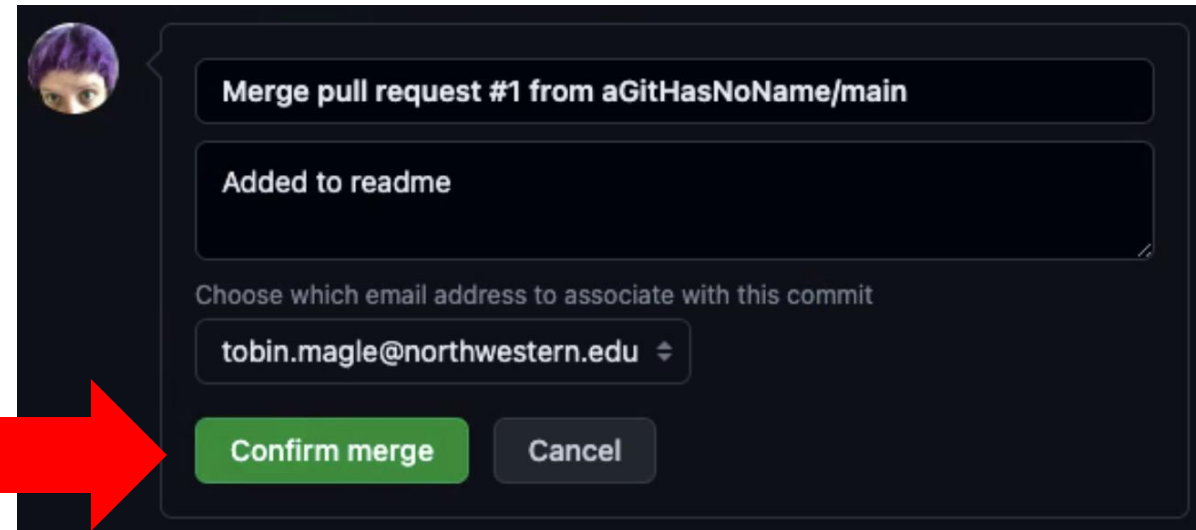


Click the warning box
"I understand, update
main".

STEP TWO (b): RESOLVE any conflicts



Click on “Merge pull request”,
then “Confirm merge”





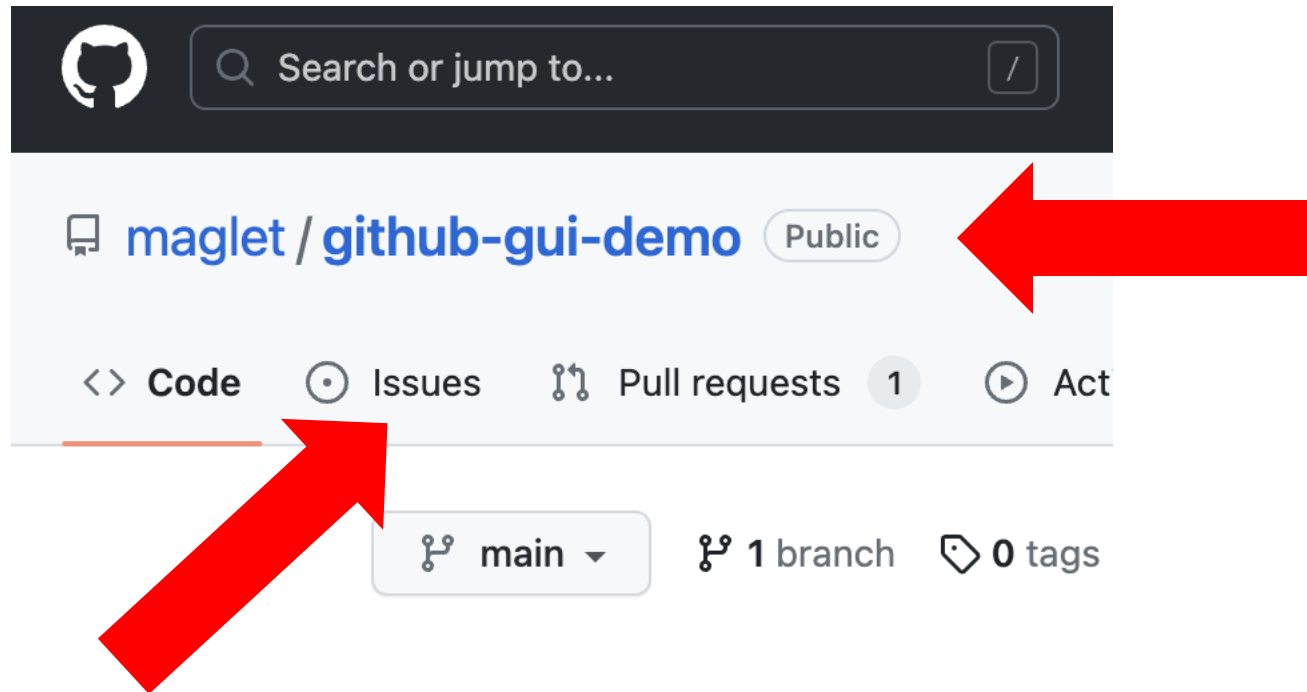
Other ways to collaborate

OPEN AN **ISSUE**

Issues are a great way to

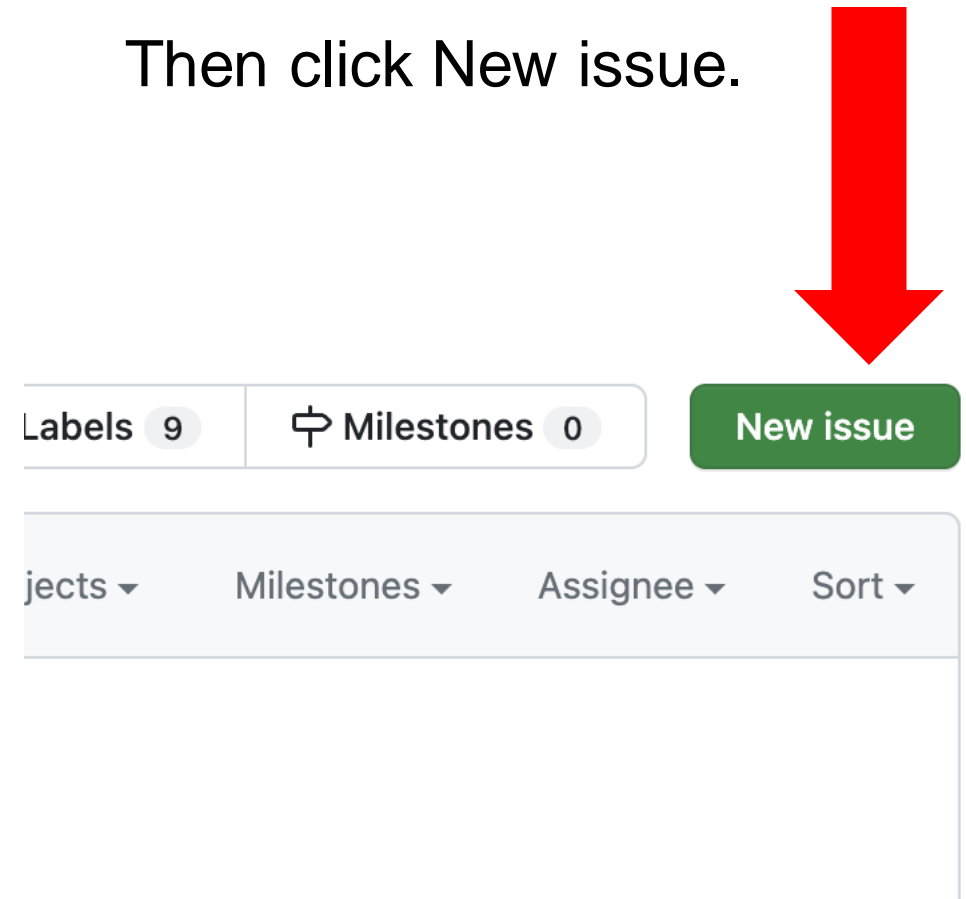
- track what still needs to be done on a project
- report bugs that need to get fixed
- have discussions about the what, why, how, and who of your code and documentation

OPEN AN **ISSUE**




On your friend's repo,
click Issues.

Then click New issue.




OPEN AN **ISSUE**

Submitting an issue will start a discussion thread.

 **maglet / github-gui-demo** Public










<> Code Issues Pull requests Actions Projects Security Insights




Let's discuss the correct number of "Ha"s


Write

Preview


H B I       @   

We could be a "no-ha" team, a "heavy-ha" team, or somewhere in the middle. Discuss.

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

 Styling with Markdown is supported

Submit new issue



The background features several thick, colorful lines in shades of purple, yellow, blue, green, red, and black. These lines are intertwined in a complex, braided pattern, creating a sense of depth and texture. The overall composition is abstract and modern.

git from the command line

git from the command line

You can also do your commits, pushes, and pulls from the command line (using git commands instead of point-and-click).

You will need a Linux or bash terminal. Mac computers come with a Linux terminal, but PC users will need to install one. We recommend WSL2 or git-bash.

git from the command line

Suggestions for learning git:

- We will teach git this summer in person.
 - June 23rd session for REU students – we will likely have a couple open spots for this class; email colby.witherup@northwestern.edu if you are interested.
 - We will teach a larger class at some point, but date is TBA. Subscribe to the Research Computing Services listserv to get the most up-to-date workshop announcements.
- Follow a self-guided tutorial online. We recommend <https://carpentries-incubator.github.io/git-novice-branch-pr/>