# Class 16

## Course Summary
## Git & GitHub

Barry Grant

UC San Diego

http://thegrantlab.org

# Today’s Menu

- Summary of major learning goals,
- Course discussion and feedback
  ( https://etherpad.wikimedia.org/p/bggn213_W22 )
- Final exam
  - ➡ Test structure, guidelines and rules
  - ➡ Topics and example questions
  - ➡ Exam preparation, discussion and open study
- Introduction to Git & GitHub (+ website portfolios)

# Today’s Menu

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  - Topics and example questions
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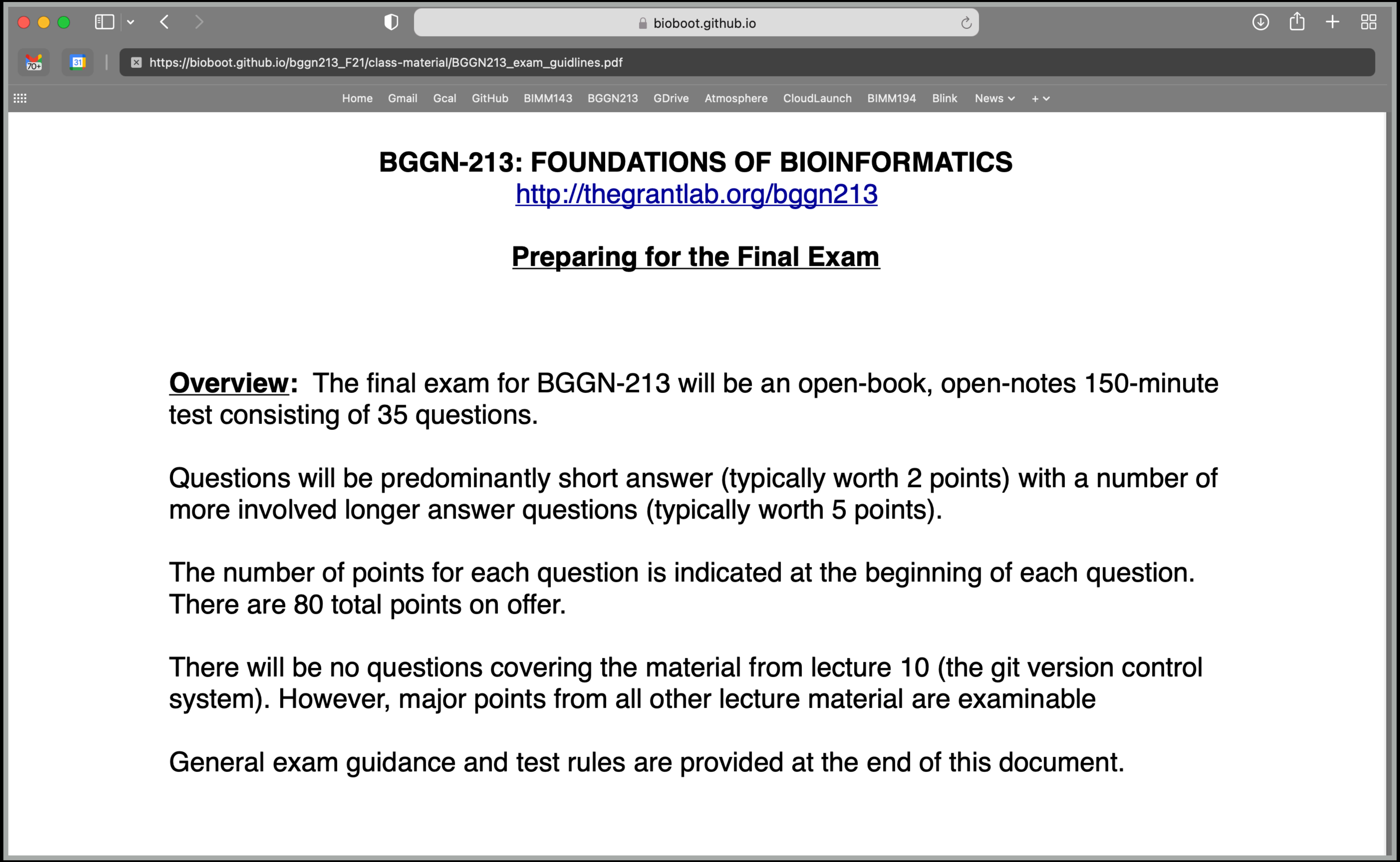
- Introduction to Git & GitHub (+ website portfolios) https://bioboot.github.io/bggn213_F21/class-material/BGGN213_exam_guidlines.pdf


bioboot.github.io
https://bioboot.github.io/bggn213_F21/class-material/BGGN213_exam_guidlines.pdf
Home Gmail Gcal GitHub BIMM143 BGGN213 GDrive Atmosphere CloudLaunch BIMM194 Blink News

## BGGN-213: FOUNDATIONS OF BIOINFORMATICS

http://thegrantlab.org/bggn213

## Preparing for the Final Exam

**Overview:** The final exam for BGGN-213 will be an open-book, open-notes 150-minute test consisting of 35 questions.

Questions will be predominantly short answer (typically worth 2 points) with a number of more involved longer answer questions (typically worth 5 points).

The number of points for each question is indicated at the beginning of each question. There are 80 total points on offer.

There will be no questions covering the material from lecture 10 (the git version control system). However, major points from all other lecture material are examinable

General exam guidance and test rules are provided at the end of this document.

**Q1**. Did you enjoy this course? (Rank in relation to others you have experienced at UCSD)?

**Q2**. Should this course be offered again?

**Q3**. If so what changes would you recommend for this course? (e.g. more/less DataCamp & Projects)

**Q4**. Was the course effectively organized (lecture and lab material online vs handout or Canvas site)?

**Q5**. What advice would you give to another student who is considering taking this course?

**Q6**. Considering both the limitations and possibilities of the subject matter and the course, how would you rate the overall effectiveness of this course and instructor?

**Q7**. Do you agree or disagree - The course developed my abilities and skills for the subject?

**Q8**. On average, how many hours per week have you spent on this course, including attending classes, doing homework's and assignments?

**Q9**. Any other comments you would like to share?

**EtherPad Link:**
https://etherpad.wikimedia.org/p/bggn213_W22

Thank you very much!

Announcement!

# Bonus:

# Bioinformatics & Genomics in Industry

## Live Stream Video

Enjoy a set of short open ended guest lectures from leading genomic scientists at **Illumina Inc.**, **Synthetic Genomics Inc.**, and the **La Jolla Institute for Allergy and Immunology**. Feel free to contact these scientists for networking and to have your questions about industry careers in Bioinformatics and Genomics answered.

# Bonus:

# Introduction to Git & GitHub

# What is Git?

(1) An unpleasant or contemptible person. Often incompetent, annoying, senile, elderly or childish in character.

(2) A modern distributed version control system with an emphasis on speed and data integrity.

git

# What is Git?

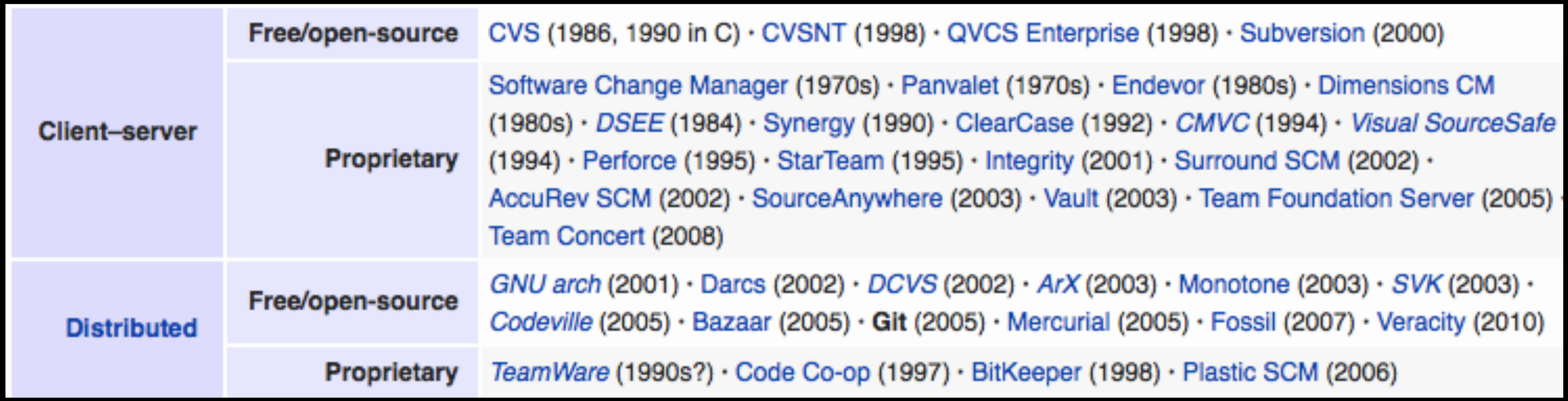
(1) An unpleasant or contemptible person. Often incompetent, annoying, senile, elderly or childish in character.

(2) A modern distributed version control system with an emphasis on speed and data integrity.

git

# Version Control

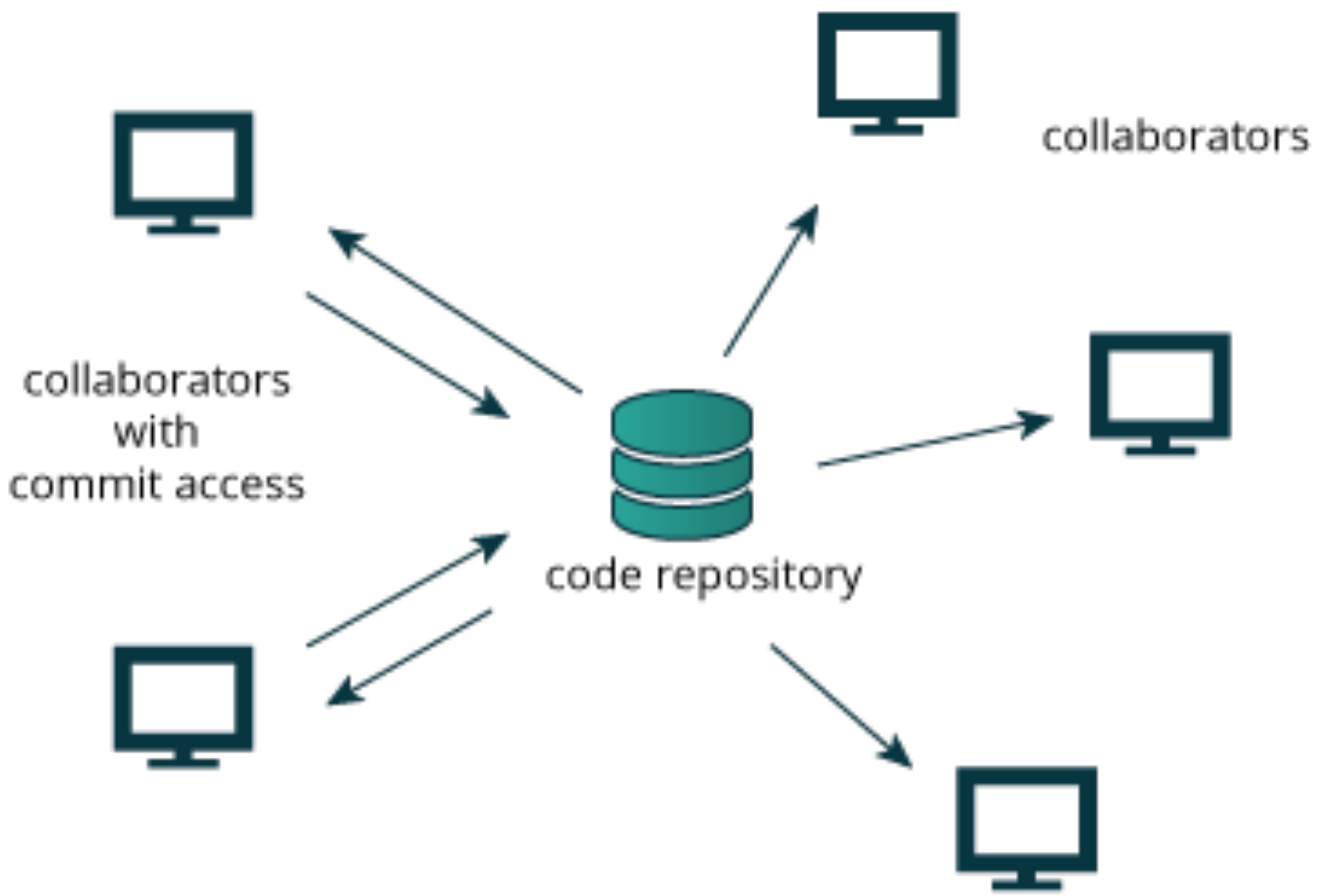
Version control systems (VCS) record changes to a file or set of files over time so that you can recall specific versions later.



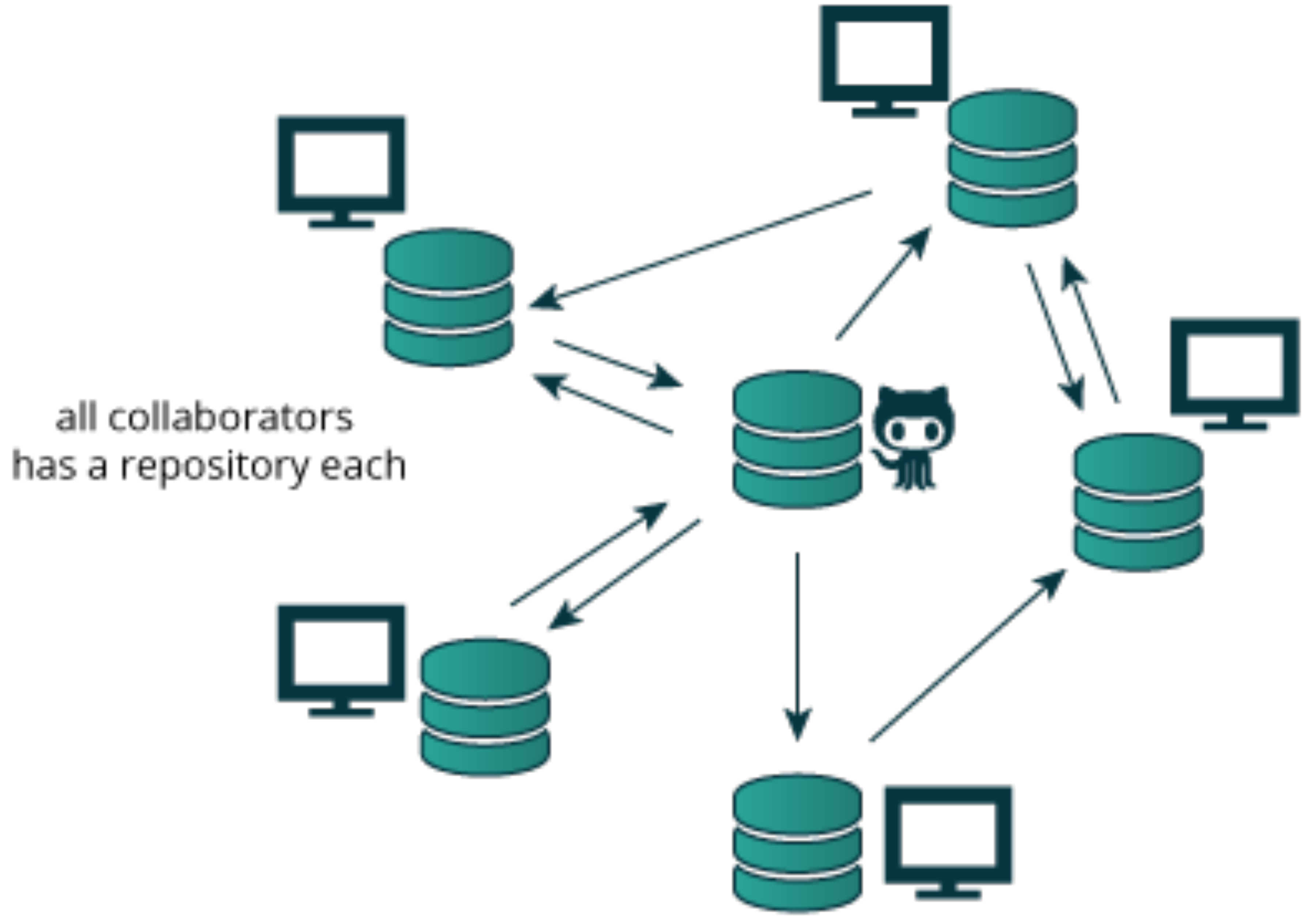
| | | |
|---|---|---|
| **Client–server** | **Free/open-source** | CVS (1986, 1990 in C) · CVSNT (1998) · QVCS Enterprise (1998) · Subversion (2000) |
| | **Proprietary** | Software Change Manager (1970s) · Panvalet (1970s) · Endevor (1980s) · Dimensions CM (1980s) · *DSEE* (1984) · Synergy (1990) · ClearCase (1992) · *CMVC* (1994) · *Visual SourceSafe* (1994) · Perforce (1995) · StarTeam (1995) · Integrity (2001) · Surround SCM (2002) · AccuRev SCM (2002) · SourceAnywhere (2003) · Vault (2003) · Team Foundation Server (2005) · Team Concert (2008) |
| **Distributed** | **Free/open-source** | *GNU arch* (2001) · Darcs (2002) · *DCVS* (2002) · *ArX* (2003) · Monotone (2003) · *SVK* (2003) · *Codeville* (2005) · Bazaar (2005) · **Git** (2005) · Mercurial (2005) · Fossil (2007) · Veracity (2010) |
| | **Proprietary** | *TeamWare* (1990s?) · Code Co-op (1997) · BitKeeper (1998) · Plastic SCM (2006) |

There are many VCS available, see: https://en.wikipedia.org/wiki/Revision_control

# Client-Server *vs* Distributed VCS

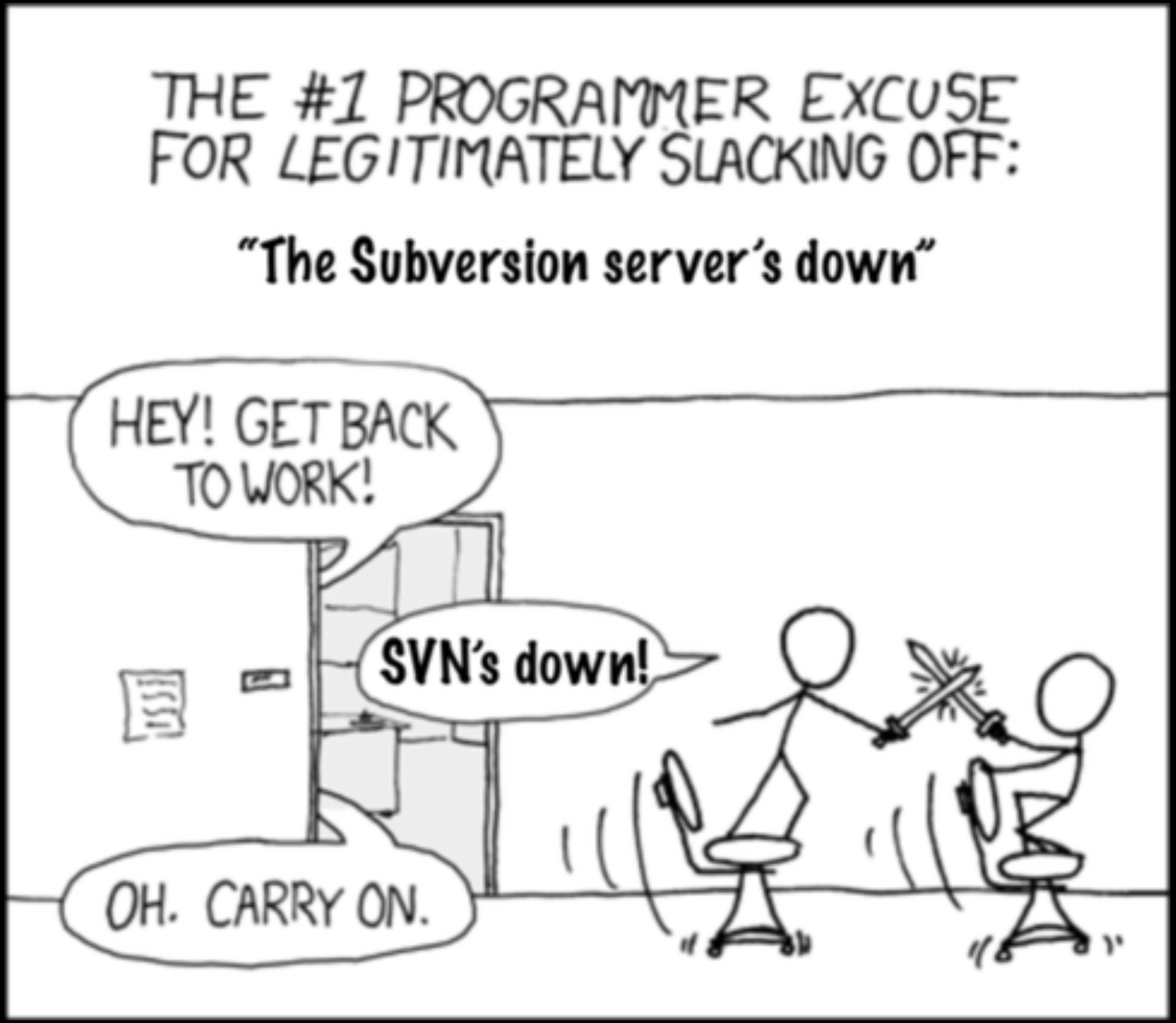


**Client-server approach**



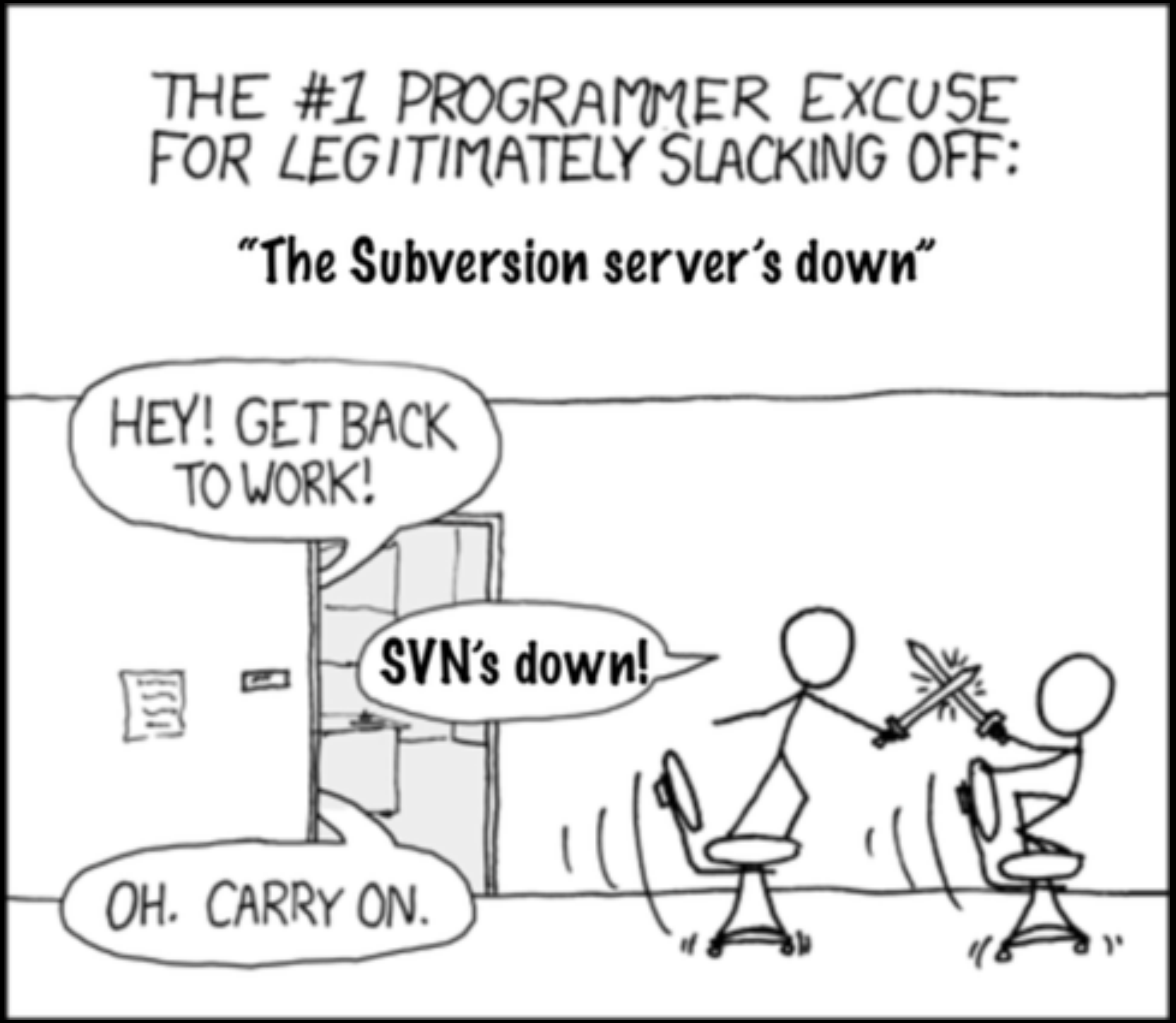
**Distributed approach**

**Distributed** version control systems (DCVS) allows multiple people to work on a given project without requiring them to share a common network.


THE #1 PROGRAMMER EXCUSE FOR LEGITIMATELY SLACKING OFF:
"The Subversion server's down"
HEY! GET BACK TO WORK!
SVN's down!
OH. CARRY ON.

http://tinyurl.com/distributed-advantages

# Git is now the most popular free VCS!


THE #1 PROGRAMMER EXCUSE FOR LEGITIMATELY SLACKING OFF:
"The Subversion server's down"
HEY! GET BACK TO WORK!
SVN's down!
OH. CARRY ON.

**Git offers**:

- Speed
- Backups
- Off-line access
- Small footprint
- Simplicity*
- Social coding

http://tinyurl.com/distributed-advantages

# Where did Git come from?

Written initially by Linus Torvalds to support Linux kernel and OS development.

Meant to be distributed, fast and more natural.

Capable of handling large projects.

Now the most popular free VCS!

# Why use Git?

Q. Would you write your lab book in pencil, then erase and overwrite it every day with new content?

Q. Would you write your lab book in pencil, then erase and overwrite it every day with new content?

Version control is the lab notebook of the digital world: it's what professionals use to keep track of what they've done and to collaborate with others.

# Why use Git?

- Provides ‘snapshots’ of your project during development and provides a full record of project history.
- Allows you to easily reproduce and rollback to past versions of analysis and compare differences. (N.B. Helps fix software regression bugs!)
- Keeps track of changes to code you use from others such as fixed bugs & new features
- Provides a mechanism for sharing, updating and collaborating (like a social network)
- Helps keep your work and software organized and available

# **Obtaining** Git

**Note:** You hopefully already have git installed!

To check open the “**Terminal**” tab in RStudio and type:

1.
```
which git
```

2.
```
git --version
```

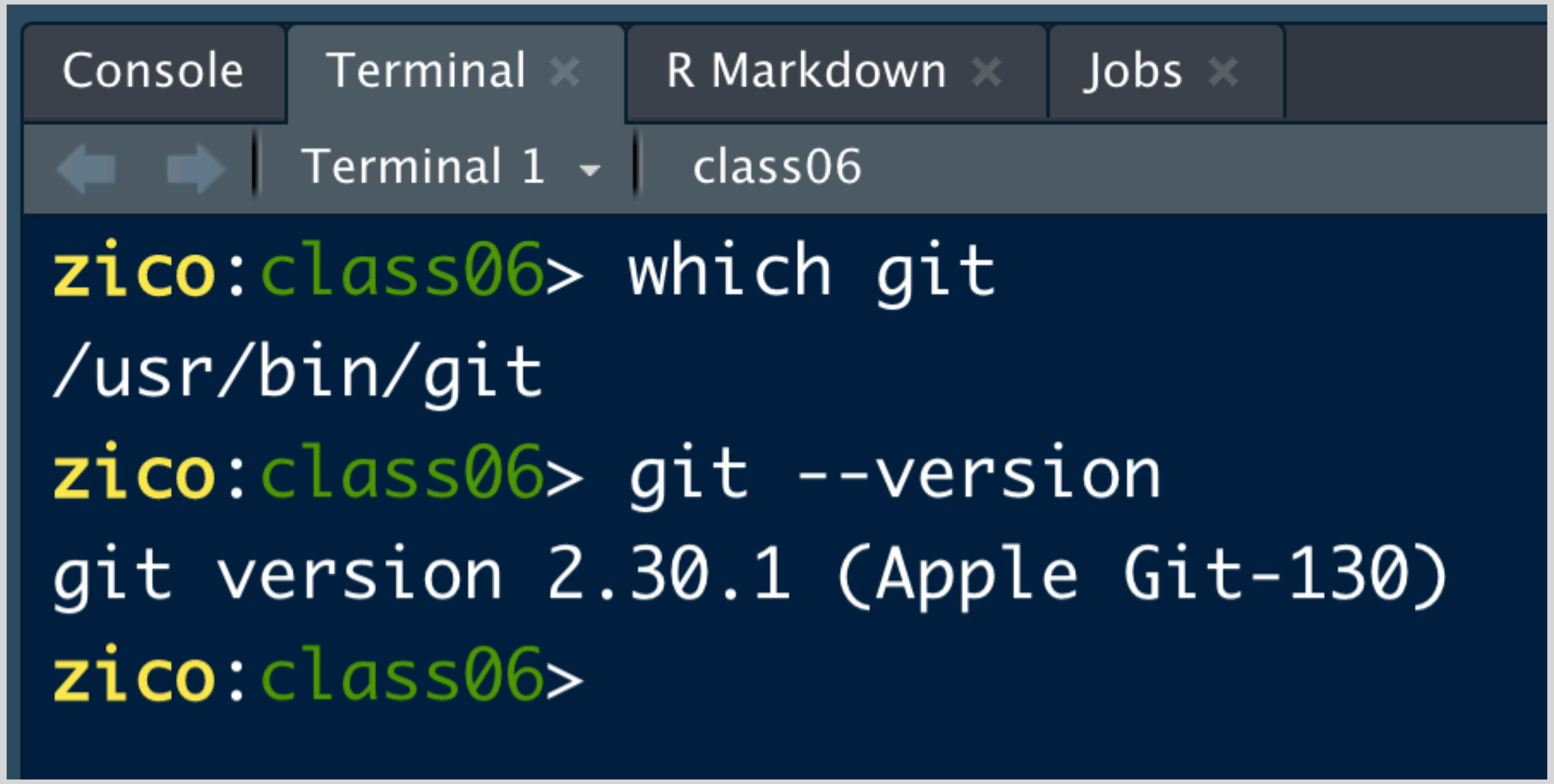
# **Obtaining** Git

**Note:** You hopefully already have git installed!
To check open the "**Terminal**" tab in RStudio and type:

1 `which git`

2 `git --version`

# **Obtaining** Git



```
zico:class06> which git
/usr/bin/git
zico:class06> git --version
git version 2.30.1 (Apple Git-130)
zico:class06>
```

**Note:** You might already have git installed
To check open the "**Terminal**" tab in RStudio and type:

1
```
which git
```

2
```
git --version
```

# **Obtaining** Git

**Windows Only (if you have problems)**

If the "which git" command did not work, try:

```
where git
```

If this works see next slide. If not then you need to install GitBash, instructions here:

Class Computer Setup Page

**Mac Only (if you have problems)**

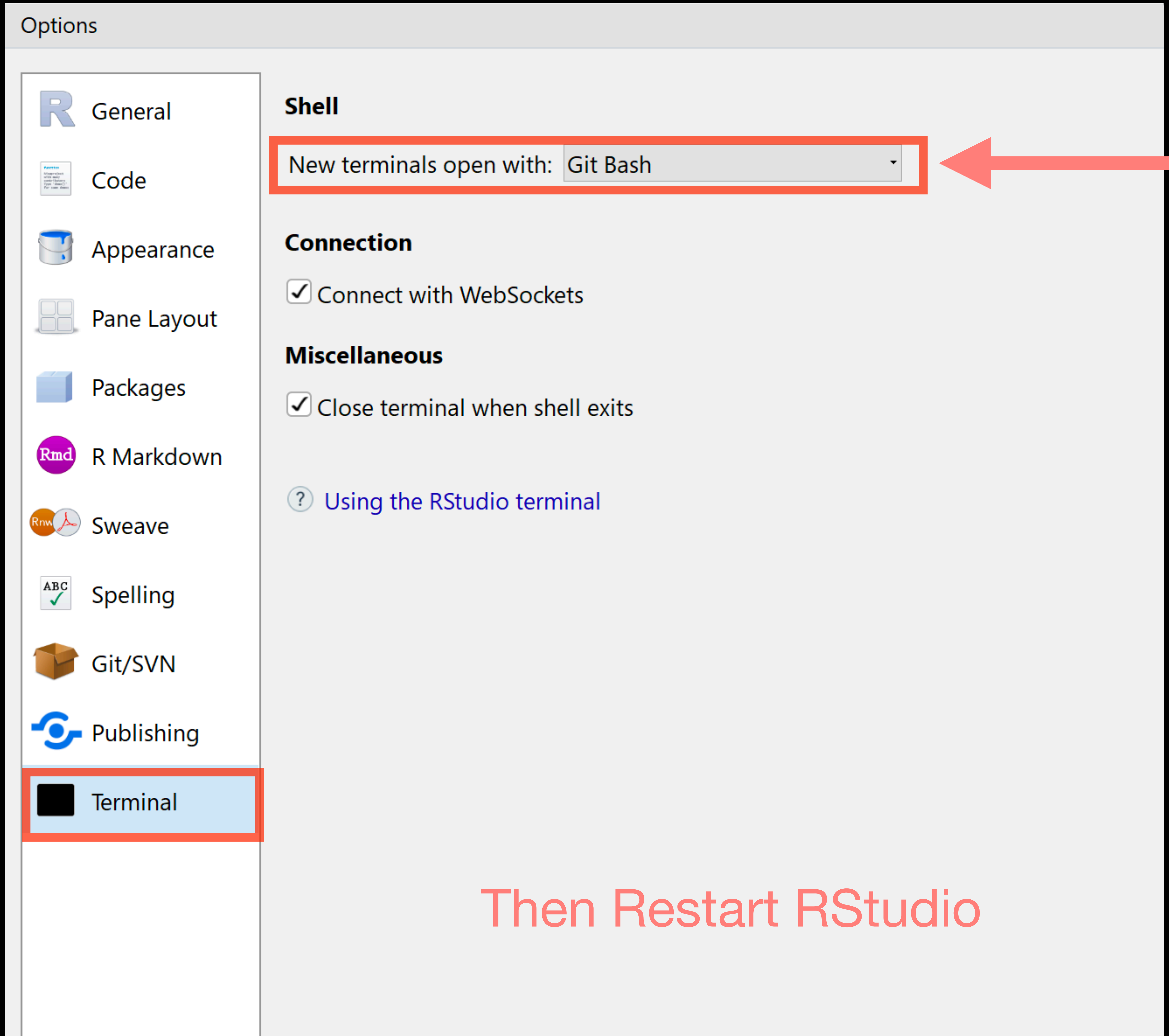
If the "which git" command did not work, you may need to install select developer tools.

In your Terminal type:

```
xcode-select --install
```

# On a Windows PC Only!

***Go to:*** **RStudio > Tools > Global Options > Terminal**



**Shell**

New terminals open with: Git Bash

**Connection**

☑ Connect with WebSockets

**Miscellaneous**

☑ Close terminal when shell exits

Using the RStudio terminal

**Make sure Git Bash is selected!**

Then Restart RStudio

Do it Yourself!

**Note:** You might already have git installed
To check open the "**Terminal**" tab in RStudio and type:

1
```
which git
```

2
```
git --version
```

# **Installing** Git

**Windows (if you have problems)**
Follow the GitBash instructions here:

Class Computer Setup Page

**Mac (if you have problems)**
In the **Terminal** instal select developer tools

```
xcode-select --install
```

# **Configuring** Git

Do it Yourself!

# **Configuring** Git

(RStudio **Terminal** Tab)
(…or *RStudio* **>** *Tools* **>** *Shell*)

```
# First tell Git who you are
> git config --global user.name  “Barry Grant”
> git config --global user.email  “bjgrant@ucsd.edu”
```

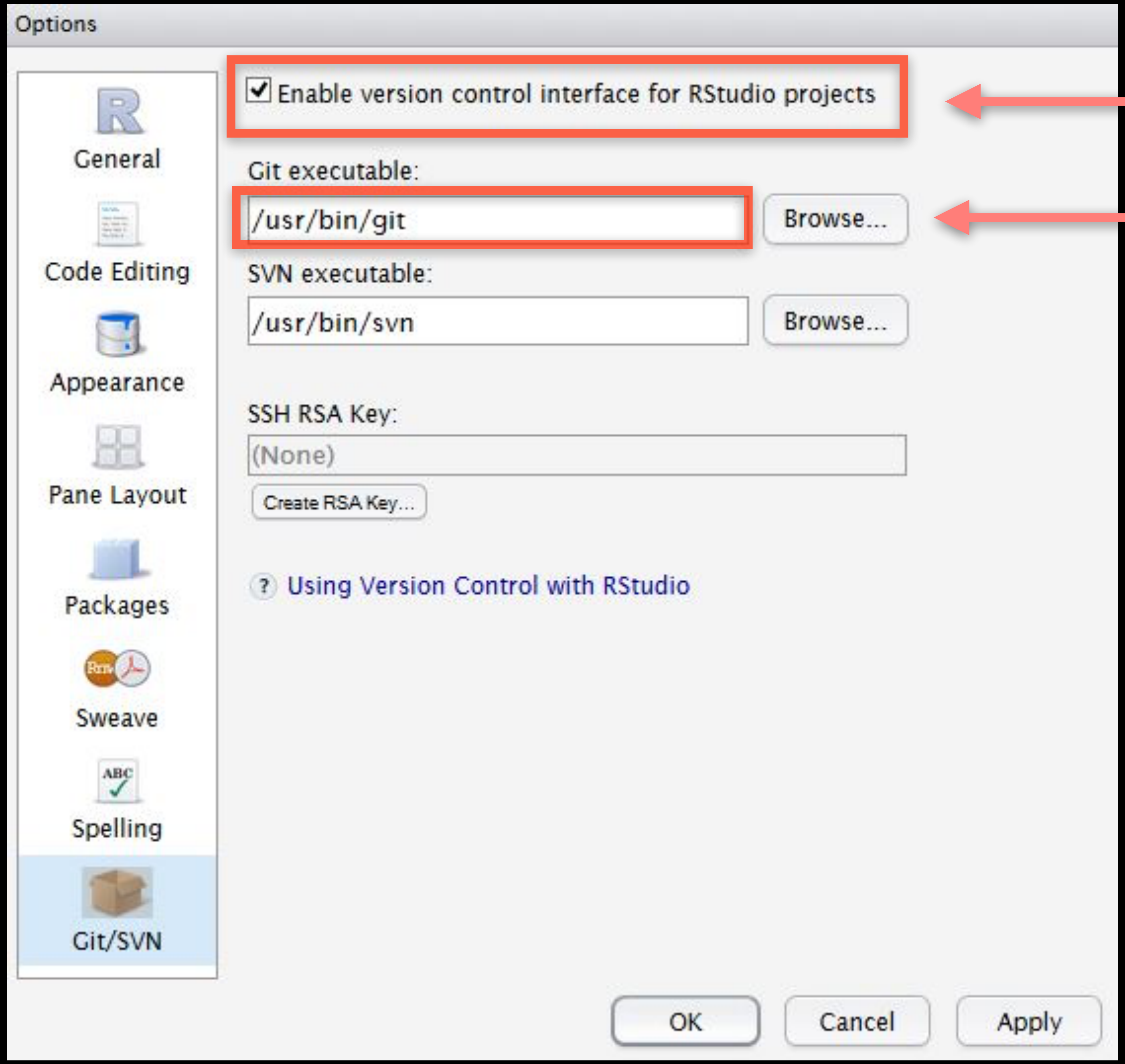
# **Configuring** RStudio

Do it Yourself!

# For Mac & Linux

## (PC on next slide)

*Go to:* **RStudio > Tools > Global Options > Git/SVN**



☑ Enable version control interface for RStudio projects

Git executable: /usr/bin/git

SVN executable: /usr/bin/svn

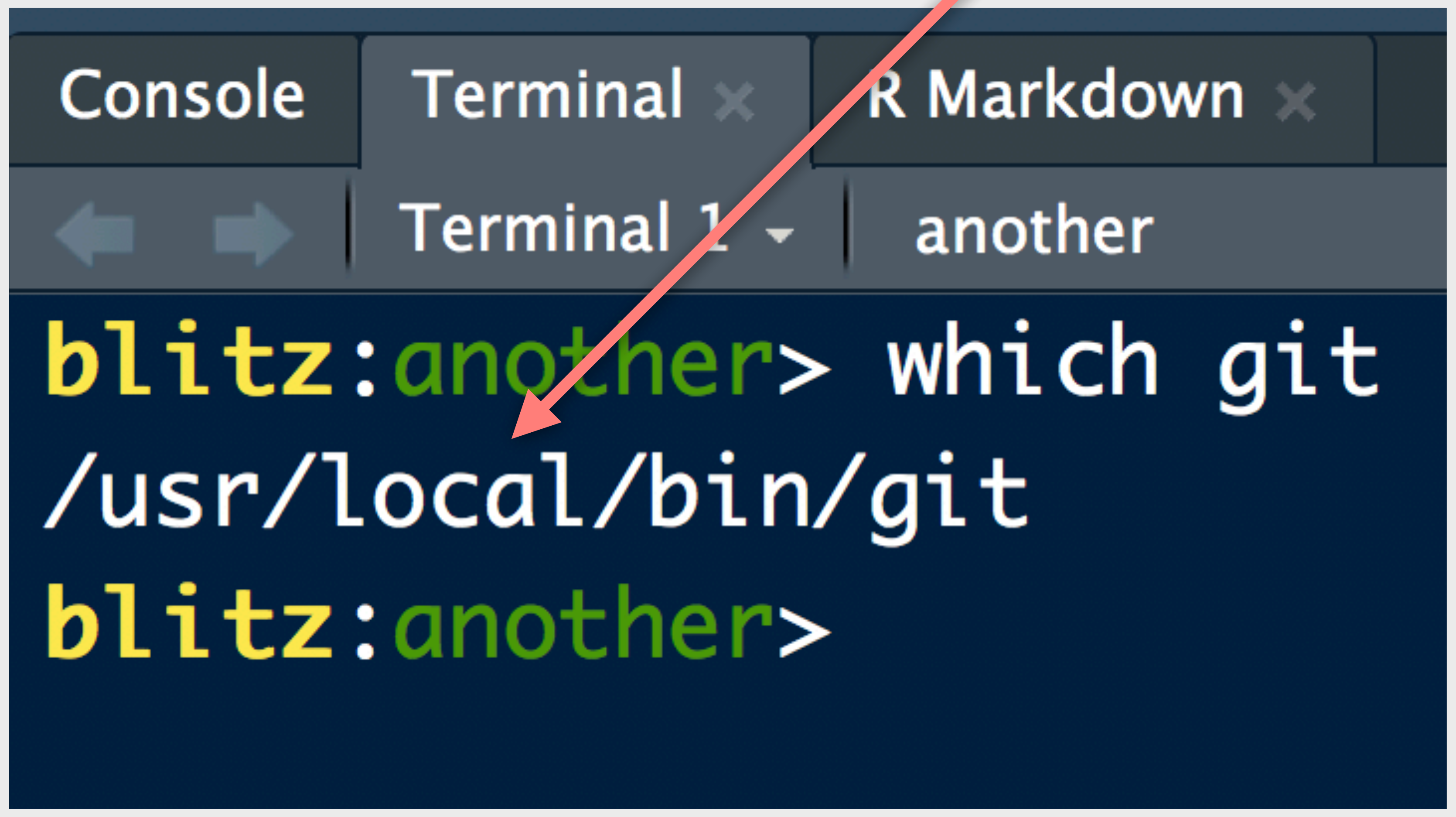
SSH RSA Key: (None)

Using Version Control with RStudio

1 *Make sure this is* ***ticked****!*

2 Make sure this is **correct**!

Check in your RStudio “Terminal” tab:

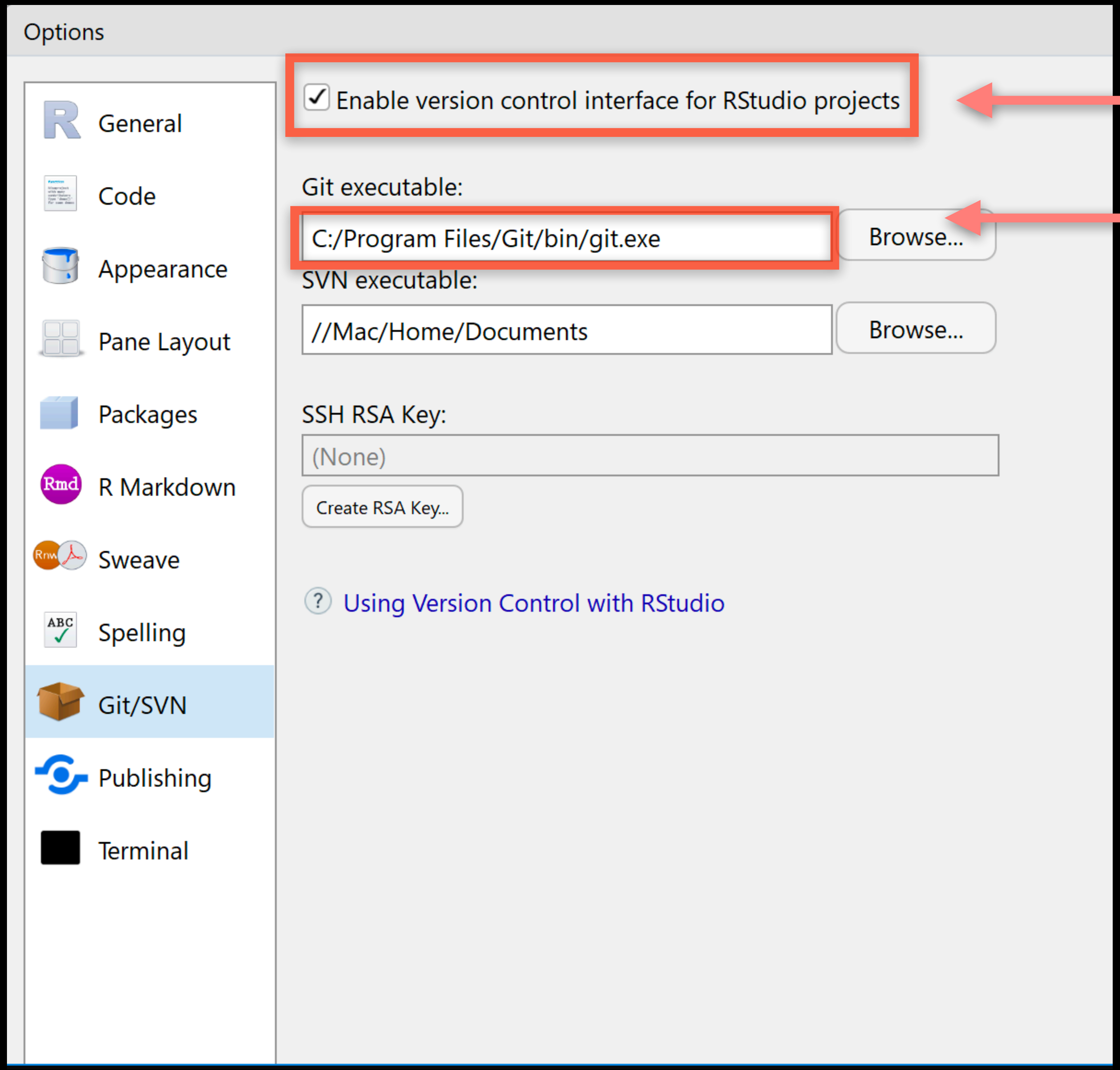


```
blitz:another> which git
/usr/local/bin/git
blitz:another>
```

Do it Yourself!

# On a PC!

*Go to:* **RStudio > Tools > Global Options > Git/SVN**


Options

☑ Enable version control interface for RStudio projects

Git executable: C:/Program Files/Git/bin/git.exe

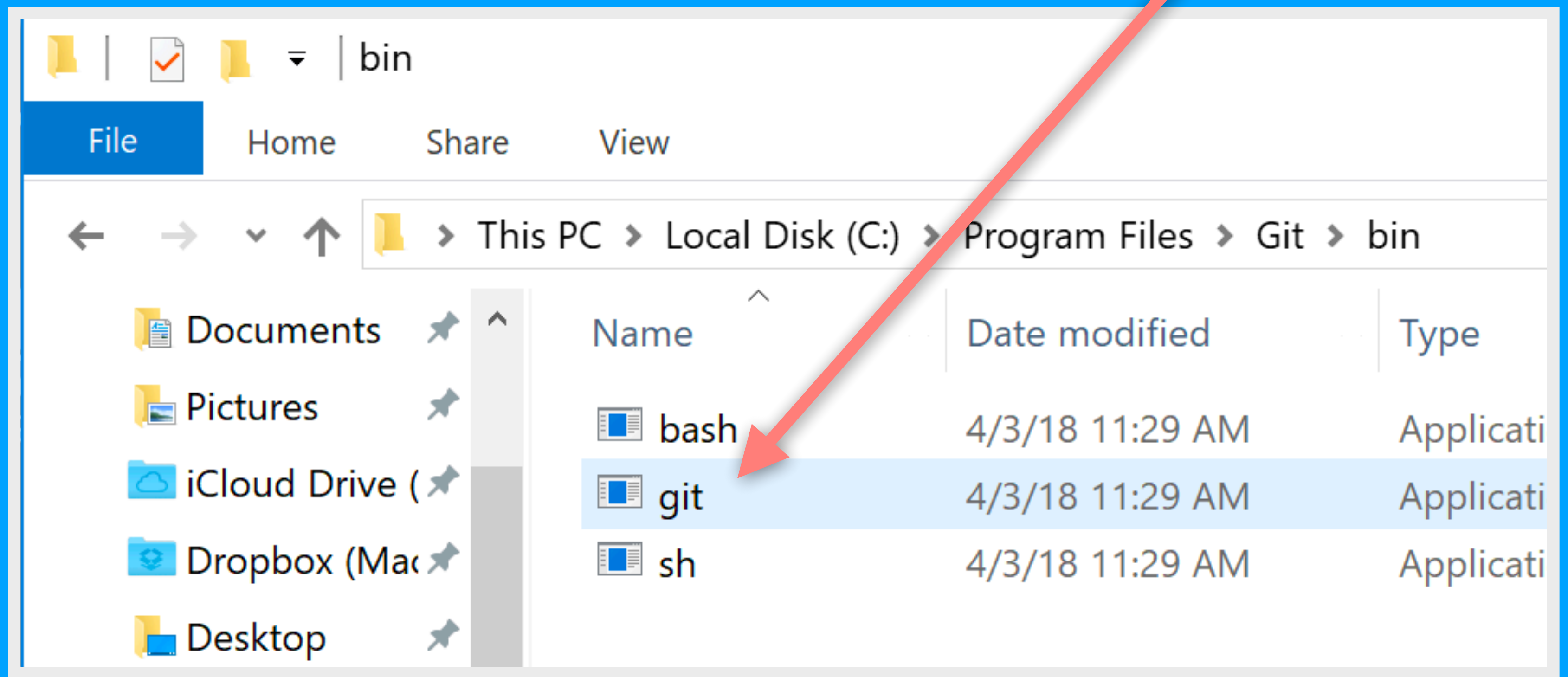
SVN executable: //Mac/Home/Documents

SSH RSA Key: (None)

1 *Make sure this is* ***ticked****!*

2 This is the PATH for **PC**!

**Check in your Windows File Explorer:**



This PC > Local Disk (C:) > Program Files > Git > bin

| Name | Date modified | Type |
|---|---|---|
| bash | 4/3/18 11:29 AM | Applicati |
| git | 4/3/18 11:29 AM | Applicati |
| sh | 4/3/18 11:29 AM | Applicati |

**Restart** RStudio!

# Using Git

# Using Git

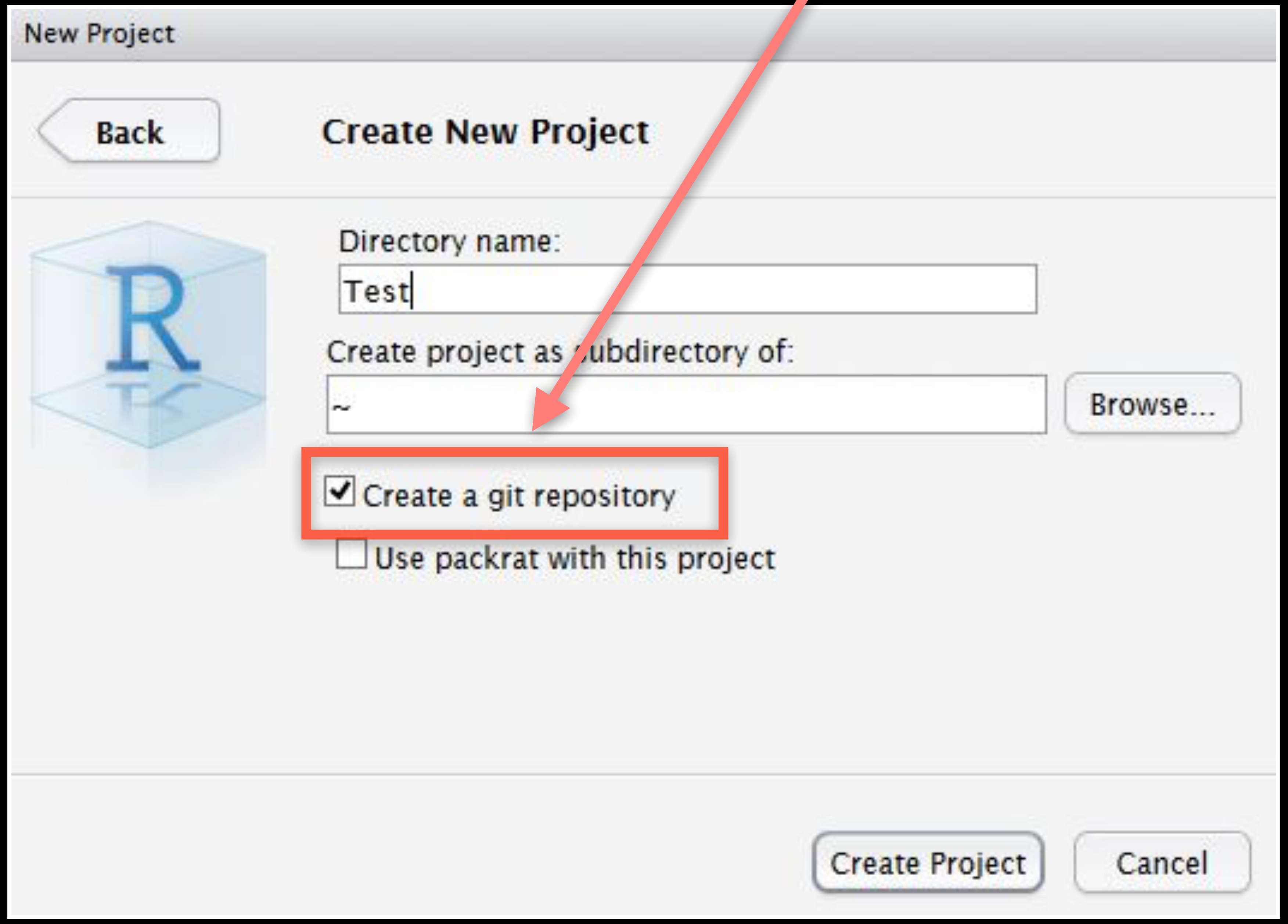
1. Initiate a Git repository.
2. Edit content (i.e. change some files).
3. Store a 'snapshot' of the current file state.*

Do it Yourself!

# Create a new **Test** RStudio project

*1* New option to create a Git repository…

*2* New Git tab…

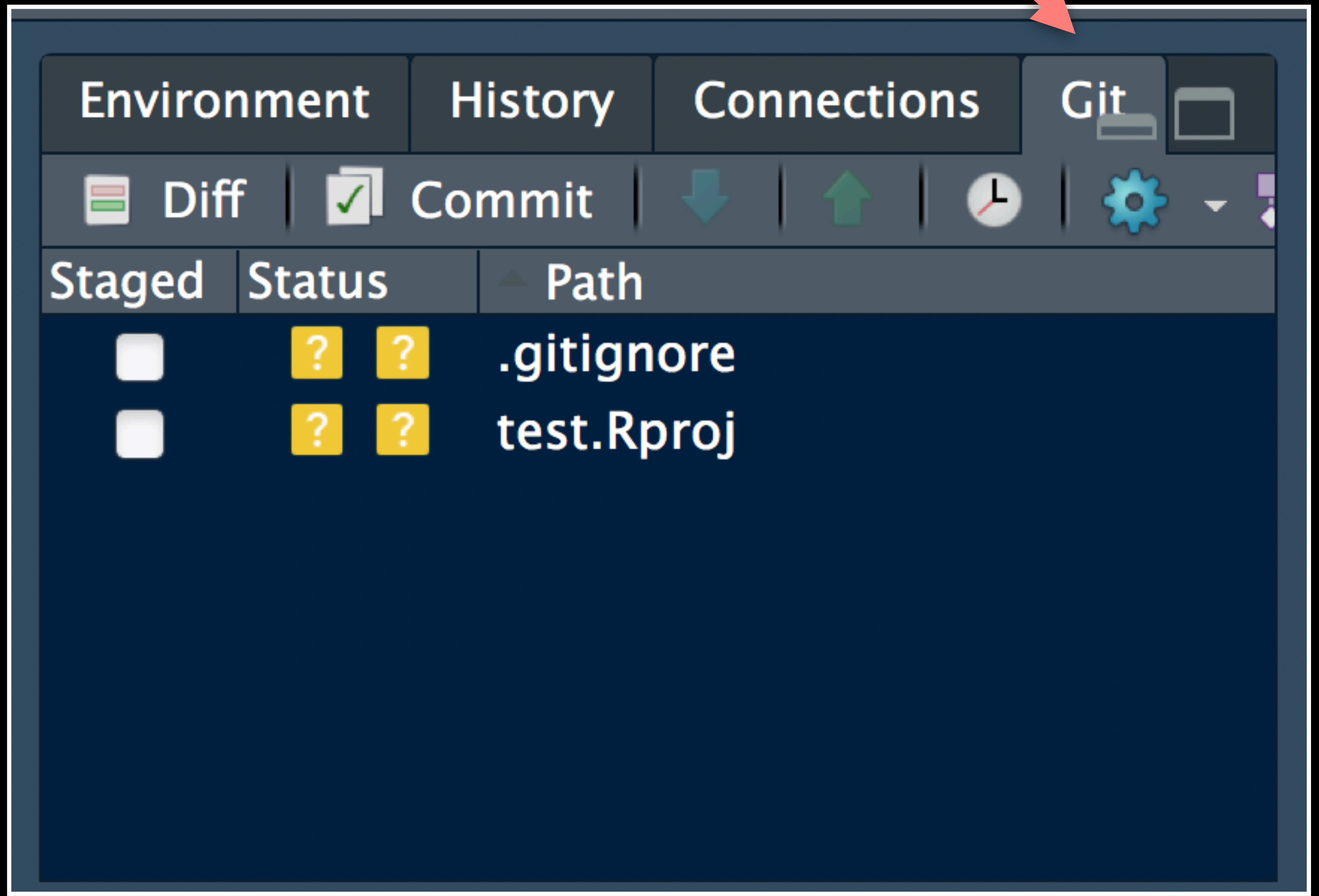


Directory name: Test

Create project as subdirectory of: ~

☑ Create a git repository

□ Use packrat with this project



| Staged | Status | Path |
|---|---|---|
| □ | ? ? | .gitignore |
| □ | ? ? | test.Rproj |

**Check if new Git options appear in RStudio?**

# Using Git in RStudio

1. **Initiate** a git repository for an RStudio Project

2. Do your work and edit content as normal

3. Store a 'snapshot' of the current file state
   (a) Periodically **add** important files to git "Staging Area"
   (b) **Commit** changes to your "git repository"

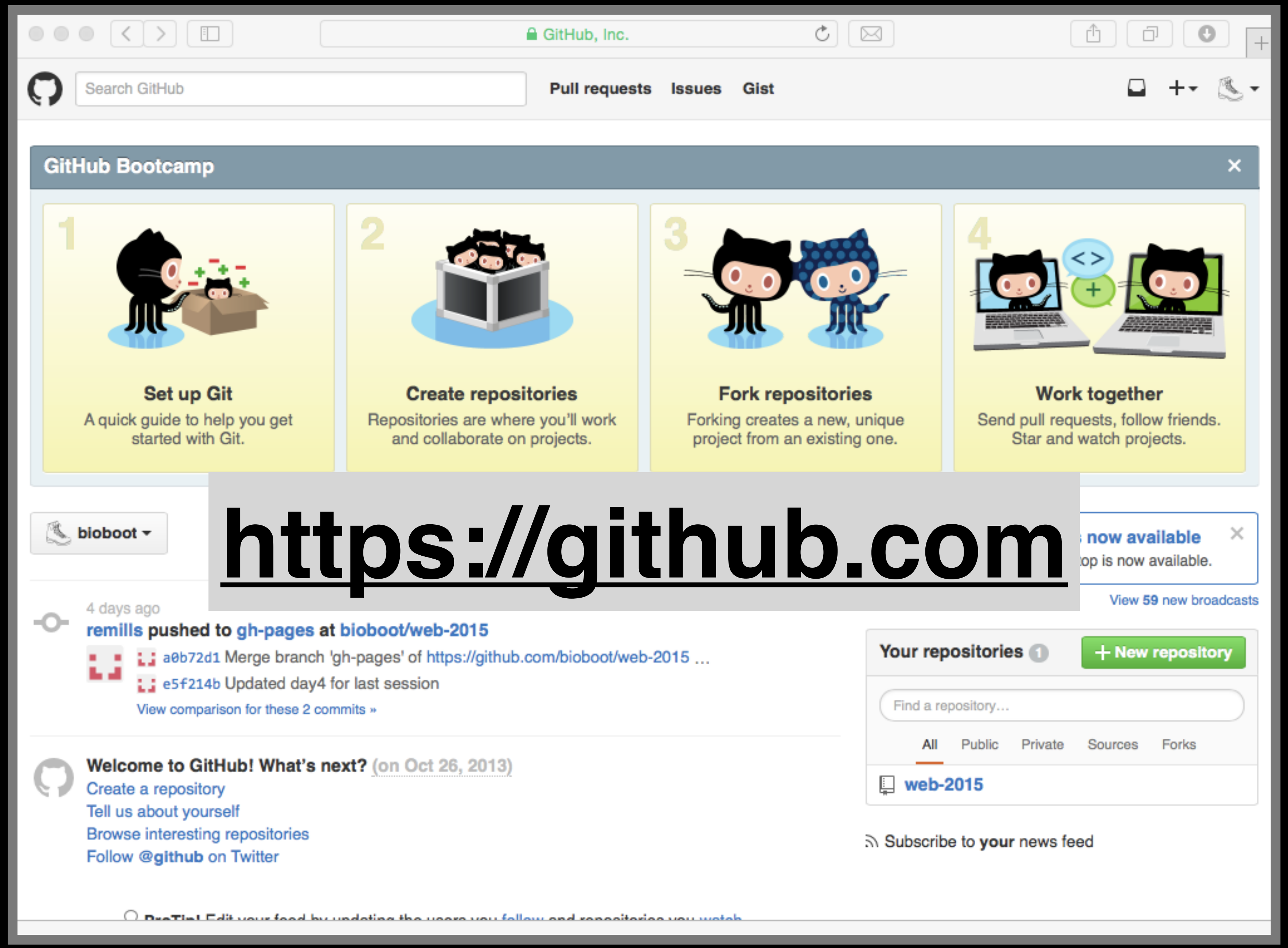
Rinse and repeat….

Follow along!

# Demo:

# GitHub & Bitbucket

**GitHub** and **Bitbucket** are two popular hosting services for Git repositories. These services allow you to share your projects and collaborate with others using both ‘**public**’ and ‘**private**’ repositories*.



Set up Git
A quick guide to help you get started with Git.

Create repositories
Repositories are where you'll work and collaborate on projects.

Fork repositories
Forking creates a new, unique project from an existing one.

Work together
Send pull requests, follow friends. Star and watch projects.

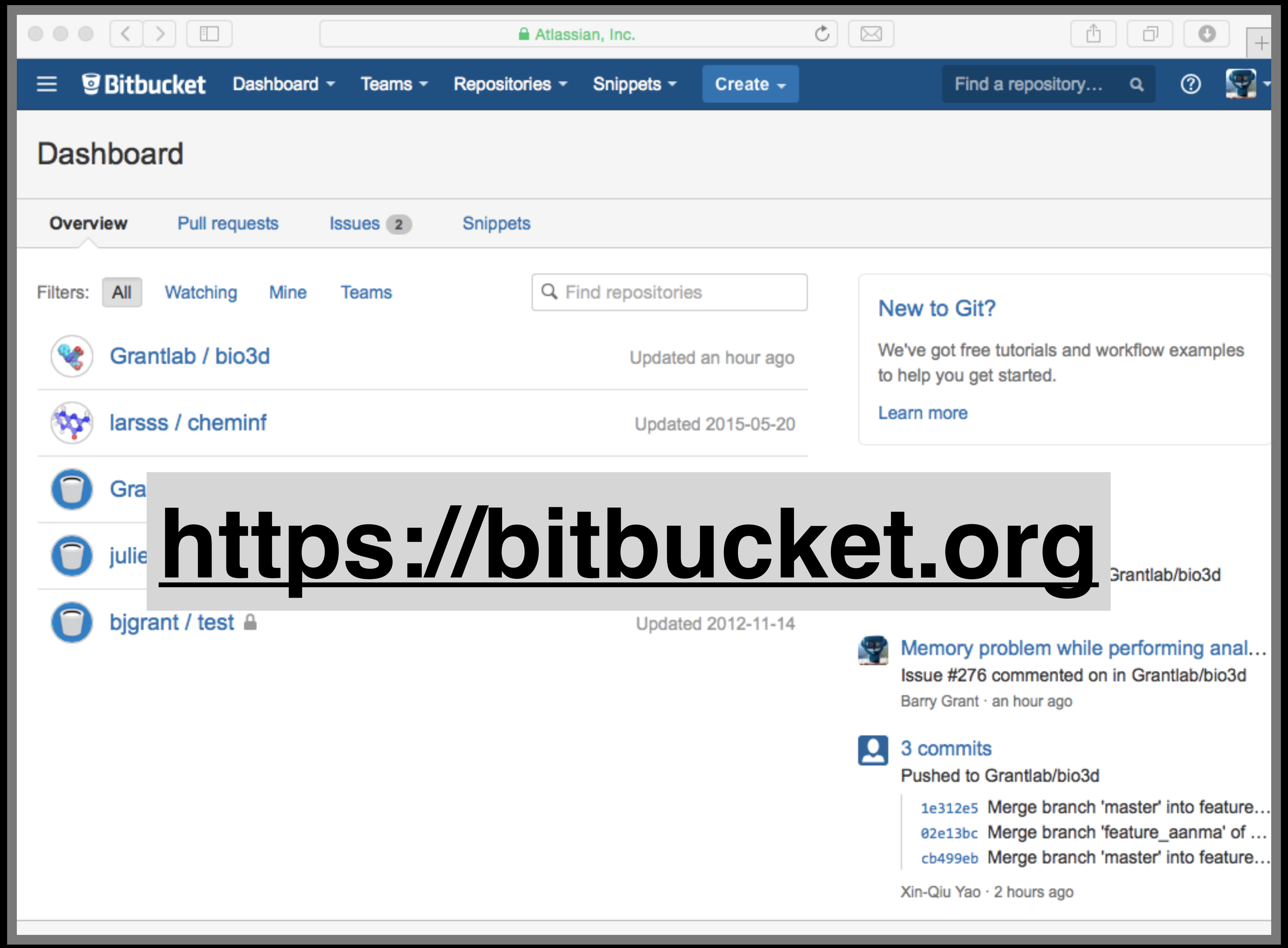
now available
op is now available.
View 59 new broadcasts

4 days ago
remills pushed to gh-pages at bioboot/web-2015
a0b72d1 Merge branch 'gh-pages' of https://github.com/bioboot/web-2015 …
e5f214b Updated day4 for last session
View comparison for these 2 commits »

Welcome to GitHub! What's next? (on Oct 26, 2013)
Create a repository
Tell us about yourself
Browse interesting repositories
Follow @github on Twitter

Subscribe to your news feed

**https://github.com**



Dashboard

Grantlab / bio3d — Updated an hour ago
larsss / cheminf — Updated 2015-05-20
Gra
julie
bjgrant / test — Updated 2012-11-14

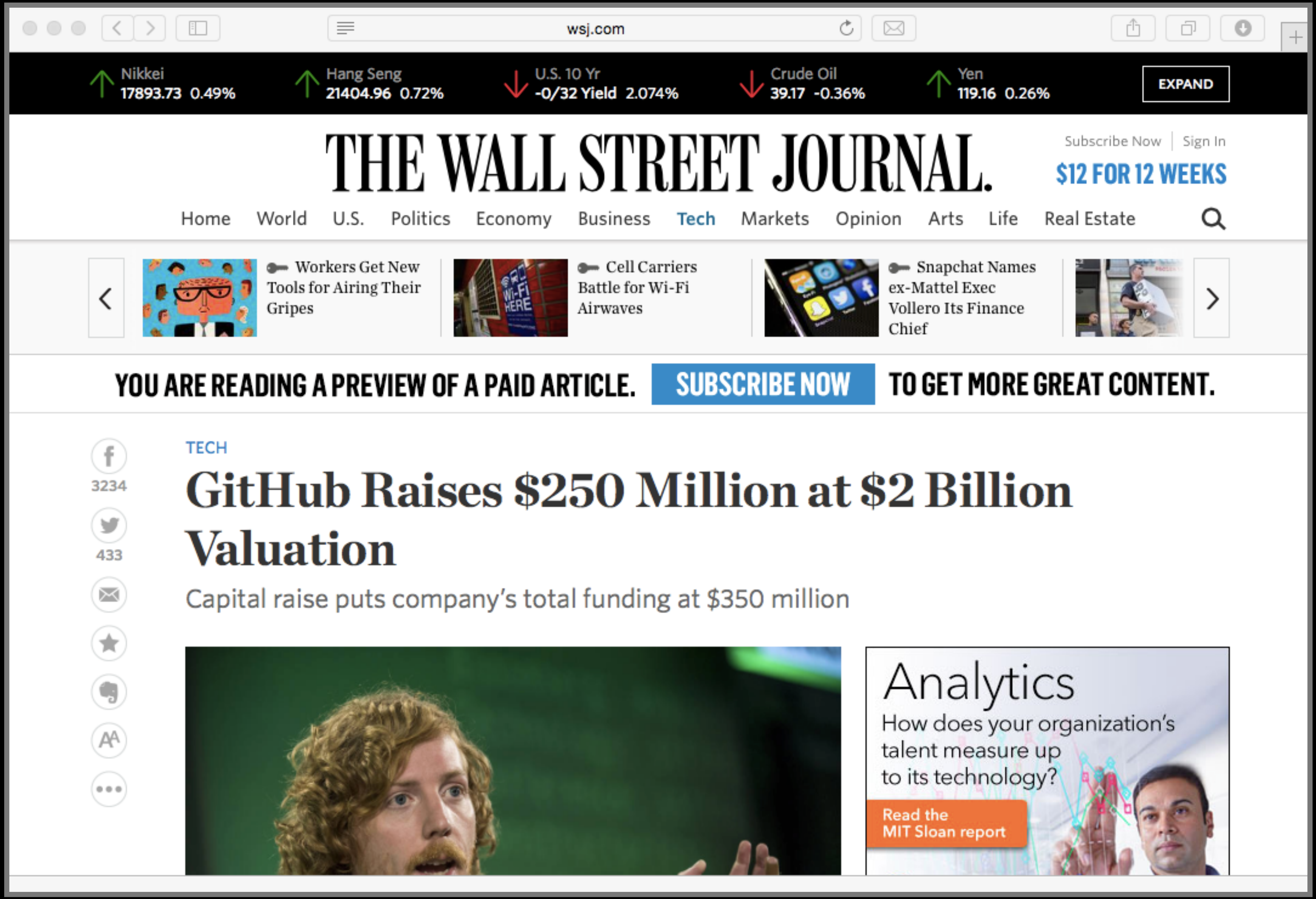
New to Git?
We've got free tutorials and workflow examples to help you get started.
Learn more

Grantlab/bio3d

Memory problem while performing anal…
Issue #276 commented on in Grantlab/bio3d
Barry Grant · an hour ago

3 commits
Pushed to Grantlab/bio3d
1e312e5 Merge branch 'master' into feature…
02e13bc Merge branch 'feature_aanma' of …
cb499eb Merge branch 'master' into feature…
Xin-Qiu Yao · 2 hours ago

**https://bitbucket.org**



THE WALL STREET JOURNAL.

Workers Get New Tools for Airing Their Gripes

Cell Carriers Battle for Wi-Fi Airwaves

Snapchat Names ex-Mattel Exec Vollero Its Finance Chief

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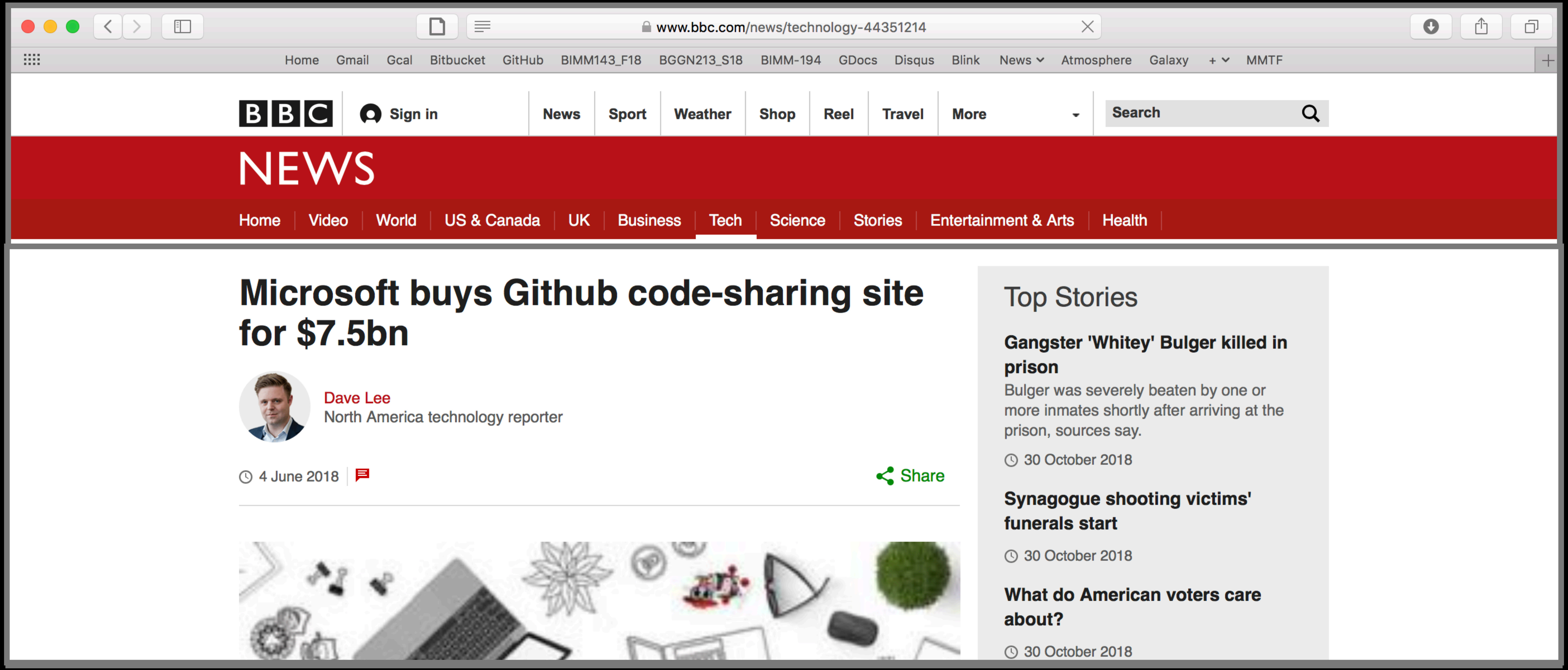
TECH

# GitHub Raises $250 Million at $2 Billion Valuation

Capital raise puts company's total funding at $350 million


www.bbc.com/news/technology-44351214
Home Gmail Gcal Bitbucket GitHub BIMM143_F18 BGGN213_S18 BIMM-194 GDocs Disqus Blink News Atmosphere Galaxy + MMTF
BBC Sign in News Sport Weather Shop Reel Travel More Search
NEWS
Home Video World US & Canada UK Business Tech Science Stories Entertainment & Arts Health

# Microsoft buys Github code-sharing site for $7.5bn

Dave Lee
North America technology reporter

4 June 2018

Share

## Top Stories

**Gangster 'Whitey' Bulger killed in prison**
Bulger was severely beaten by one or more inmates shortly after arriving at the prison, sources say.
30 October 2018

**Synagogue shooting victims' funerals start**
30 October 2018

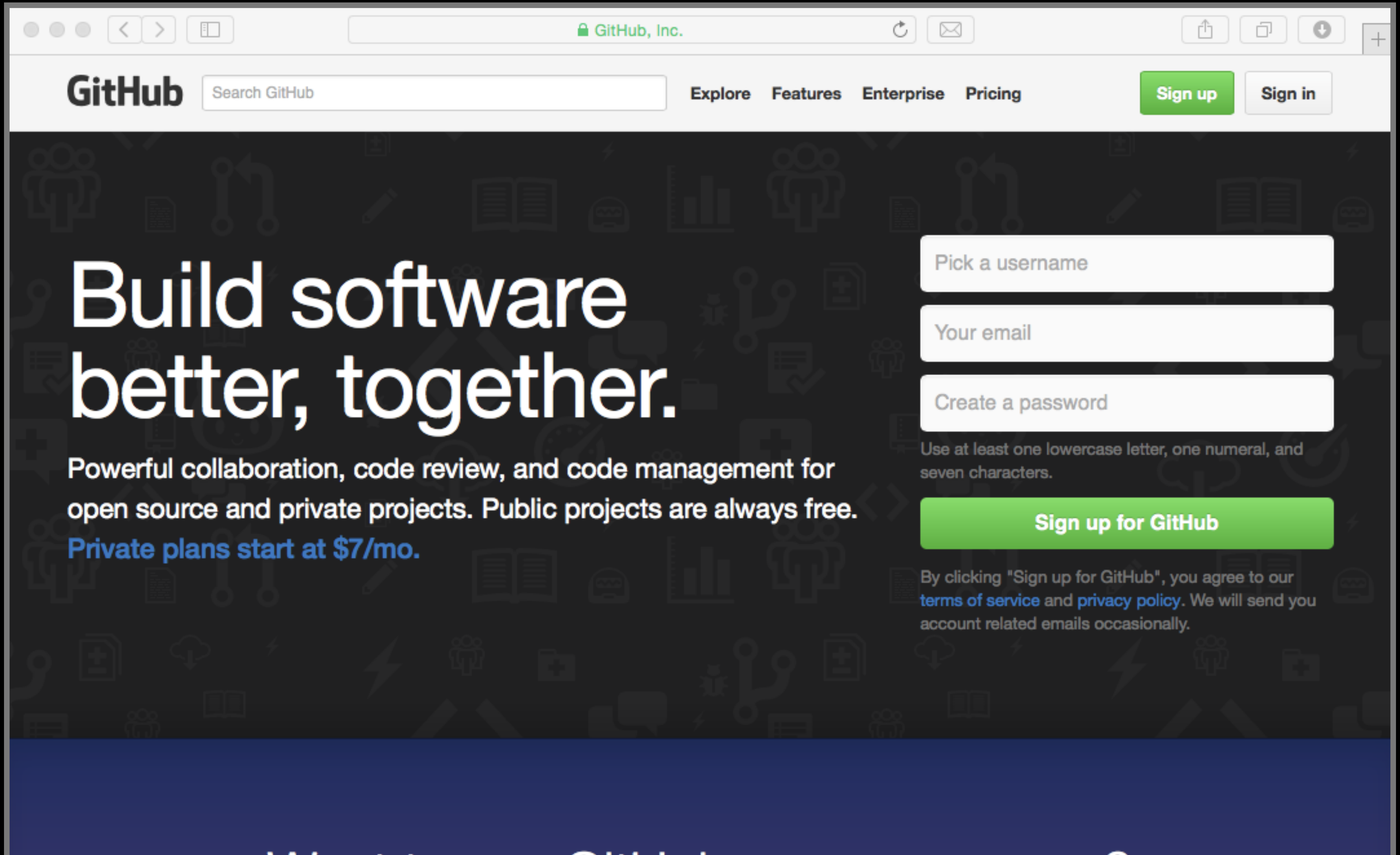
**What do American voters care about?**
30 October 2018

# What is the big deal?

- At the simplest level GitHub and Bitbucket offer **backup** of your projects history and a centralized mechanism for **sharing** with others by putting **your Git repo online**.
  - GitHub in particular is often referred to as the “nerds FaceBook and LinkedIn combined”.
- At their core both services **offer a new paradigm for open collaborative project development**, particularly for software.
  - In essence they allow anybody to contribute to any public project and get acknowledgment.

# First sign up for a GitHub account

[https://github.com](https://github.com)



## Build software better, together.

Powerful collaboration, code review, and code management for open source and private projects. Public projects are always free. Private plans start at $7/mo.

Pick a username

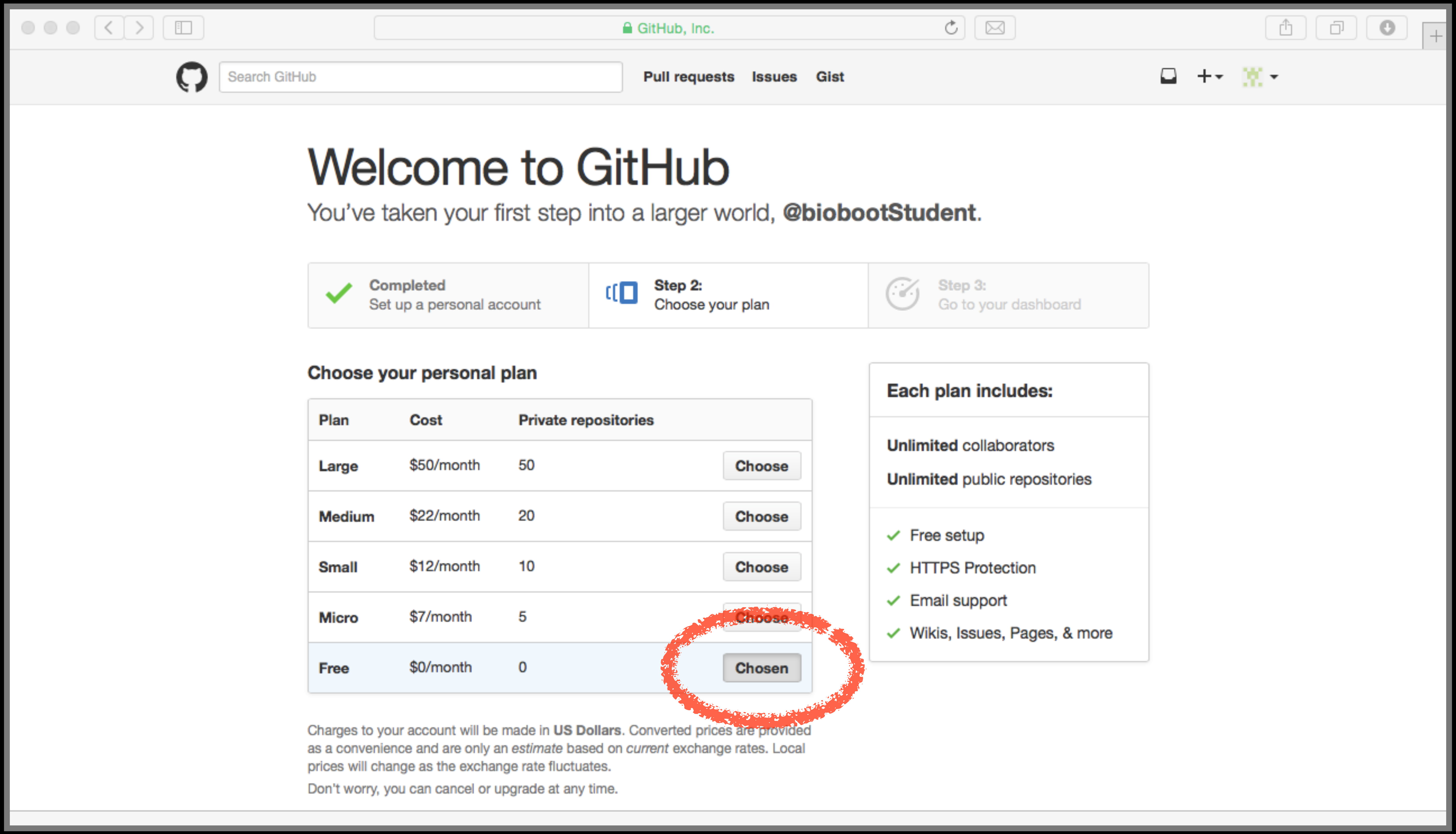
Your email

Create a password

Use at least one lowercase letter, one numeral, and seven characters.

By clicking "Sign up for GitHub", you agree to our terms of service and privacy policy. We will send you account related emails occasionally.

# Pick the FREE plan!



## Welcome to GitHub

You've taken your first step into a larger world, **@biobootStudent**.

✓ Completed
Set up a personal account

**Step 2:**
Choose your plan

Step 3:
Go to your dashboard

**Choose your personal plan**

| Plan | Cost | Private repositories | |
|---|---|---|---|
| **Large** | $50/month | 50 | Choose |
| **Medium** | $22/month | 20 | Choose |
| **Small** | $12/month | 10 | Choose |
| **Micro** | $7/month | 5 | Choose |
| **Free** | $0/month | 0 | [✓ Chosen] |

Charges to your account will be made in **US Dollars**. Converted prices are provided as a convenience and are only an *estimate* based on *current* exchange rates. Local prices will change as the exchange rate fluctuates.

Don't worry, you can cancel or upgrade at any time.

**Each plan includes:**

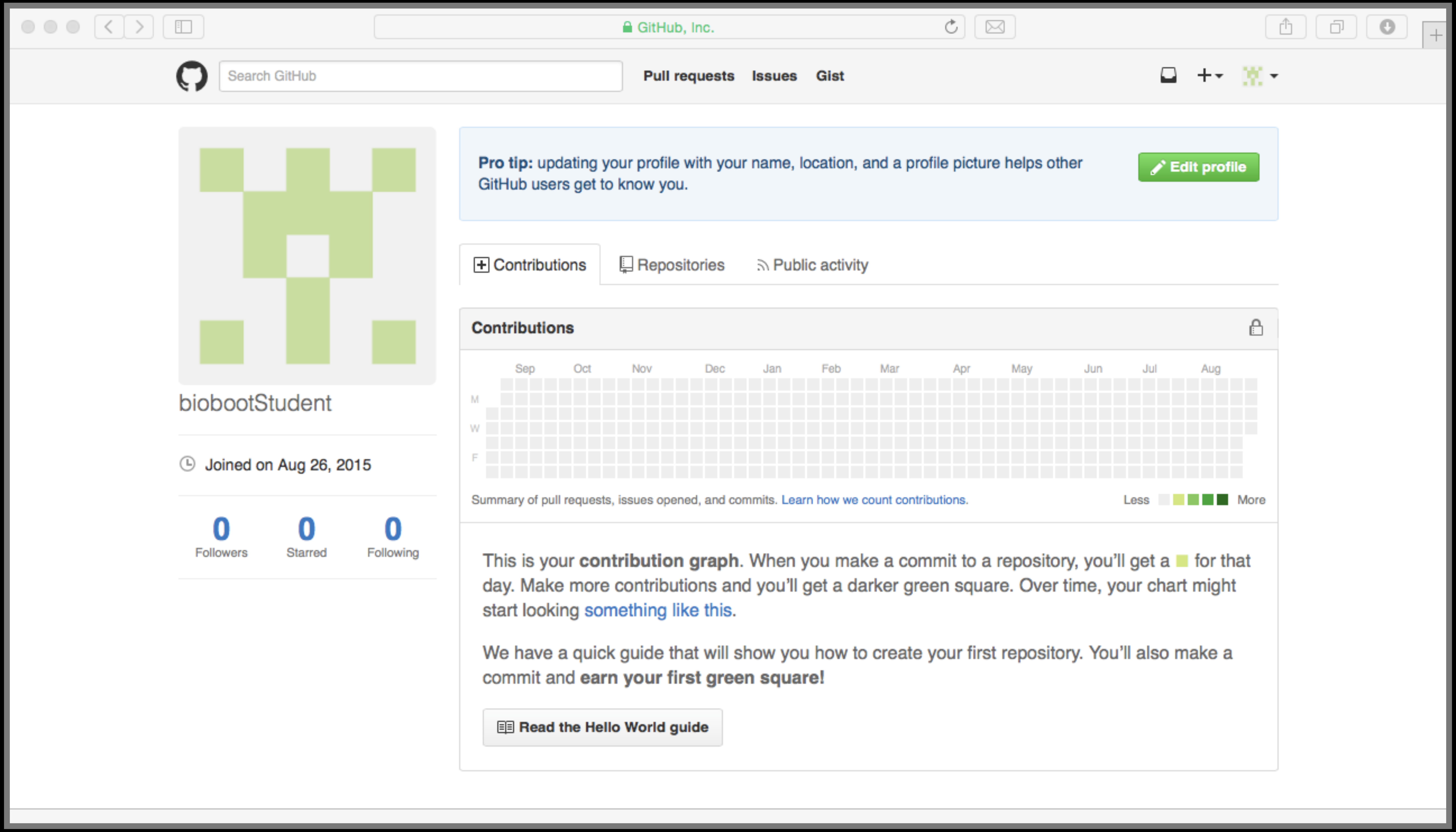
**Unlimited** collaborators

**Unlimited** public repositories

- ✓ Free setup
- ✓ HTTPS Protection
- ✓ Email support
- ✓ Wikis, Issues, Pages, & more

# Your GitHub homepage

Check your email for verification request



**Pro tip:** updating your profile with your name, location, and a profile picture helps other GitHub users get to know you.

Joined on Aug 26, 2015

0 Followers

0 Starred

0 Following

Summary of pull requests, issues opened, and commits. Learn how we count contributions.

This is your **contribution graph**. When you make a commit to a repository, you'll get a 🟩 for that day. Make more contributions and you'll get a darker green square. Over time, your chart might start looking something like this.

We have a quick guide that will show you how to create your first repository. You'll also make a commit and **earn your first green square!**

**Read the Hello World guide**

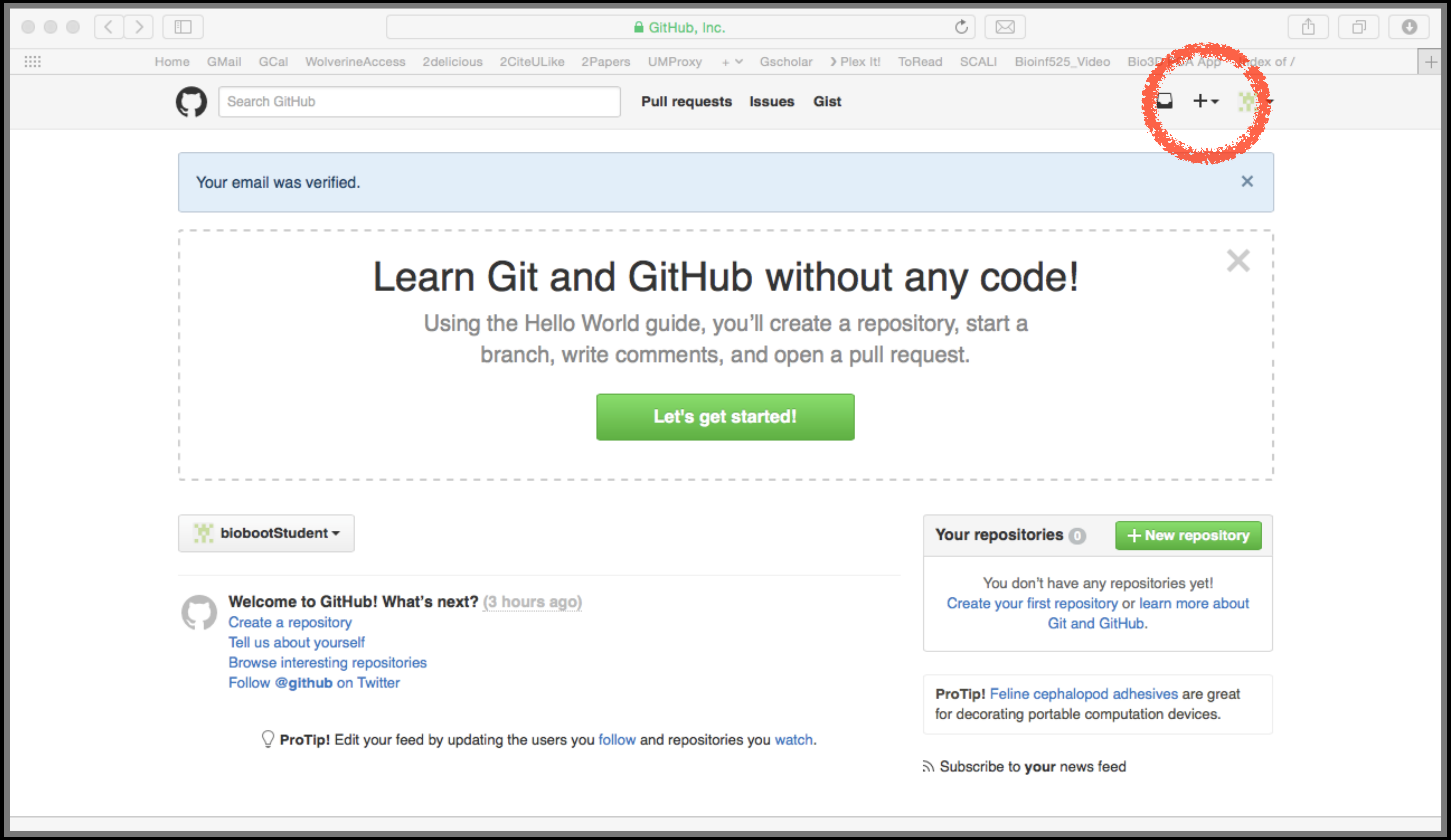
# Connecting RStudio to GitHub

Create a **Personal Access Token** (PAT) on GitHub

**See section 4 of lab worksheet**

# Skip the hello-world tutorial

https://guides.github.com/activities/hello-world/


GitHub, Inc.
Home GMail GCal WolverineAccess 2delicious 2CiteULike 2Papers UMProxy Gscholar Plex It! ToRead SCALI Bioinf525_Video
Search GitHub
Pull requests
Issues
Gist
+
Let's get started!
biobootStudent
+ New repository

Your email was verified.

Learn Git and GitHub without any code!

Using the Hello World guide, you'll create a repository, start a branch, write comments, and open a pull request.

Welcome to GitHub! What's next? (3 hours ago)

Create a repository
Tell us about yourself
Browse interesting repositories
Follow @github on Twitter

ProTip! Edit your feed by updating the users you follow and repositories you watch.

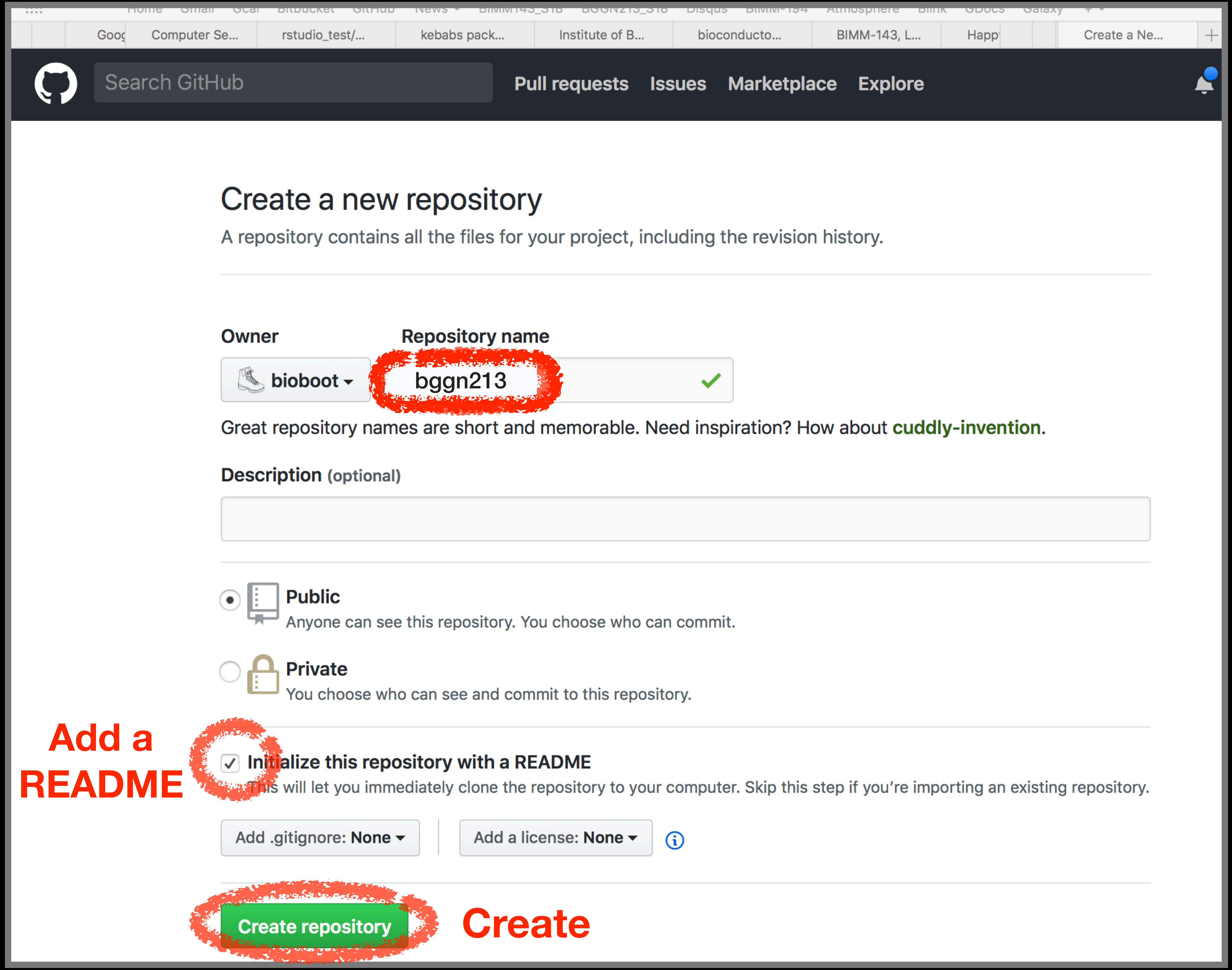
Your repositories 0

You don't have any repositories yet! Create your first repository or learn more about Git and GitHub.

ProTip! Feline cephalopod adhesives are great for decorating portable computation devices.

Subscribe to your news feed

# Name your repo
# bggn213



## Create a new repository

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

**Owner** bioboot ▾ **Repository name** bggn213 ✓

Great repository names are short and memorable. Need inspiration? How about **cuddly-invention**.

**Description** (optional)

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

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

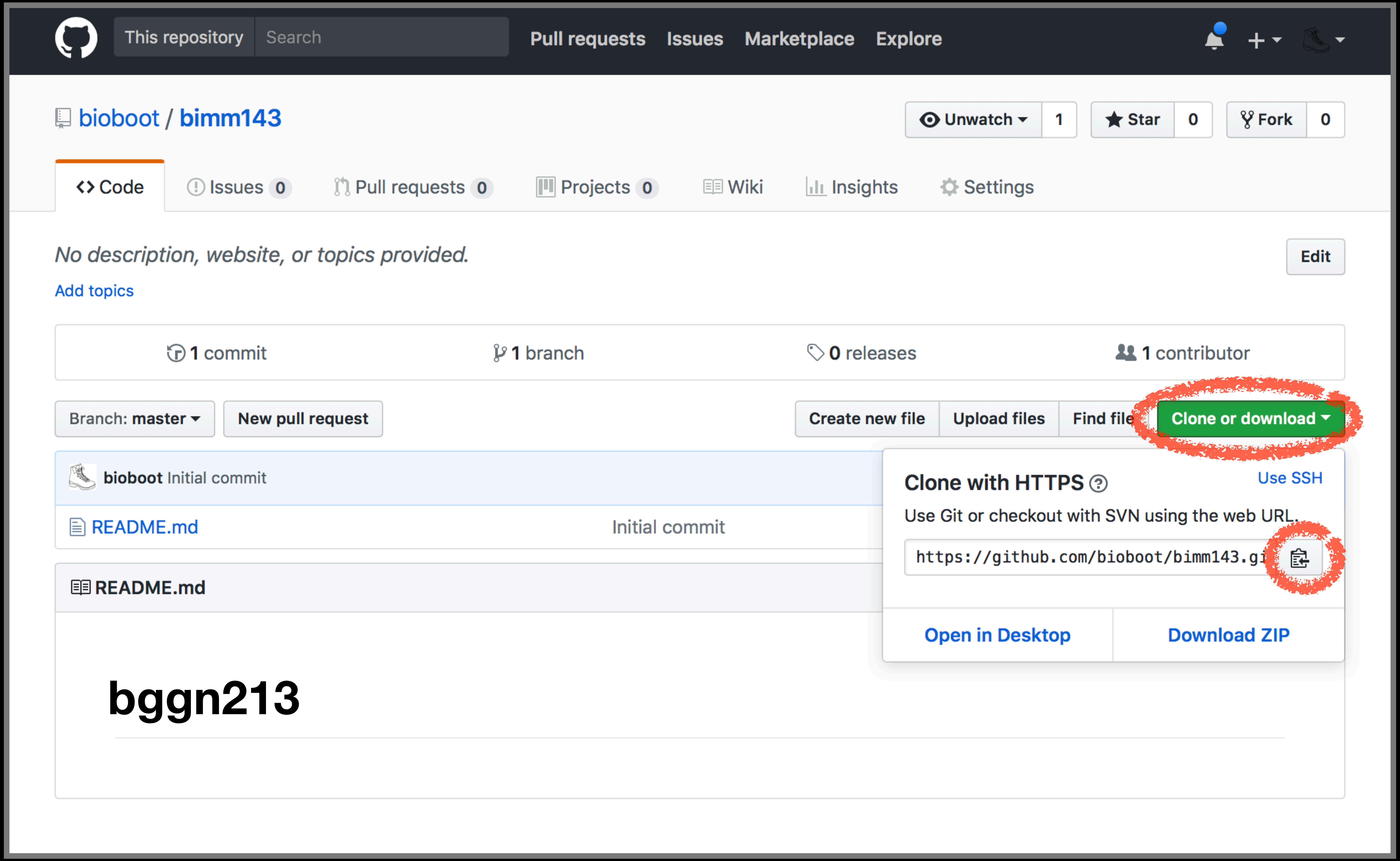
☑ **Initialize this repository with a README**
This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.

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

**Add a README**

**Create**

# Copy the “**Clone**” HTTPS link



bioboot / bimm143

*No description, website, or topics provided.*

1 commit 1 branch 0 releases 1 contributor

bioboot Initial commit

README.md Initial commit

Clone with HTTPS

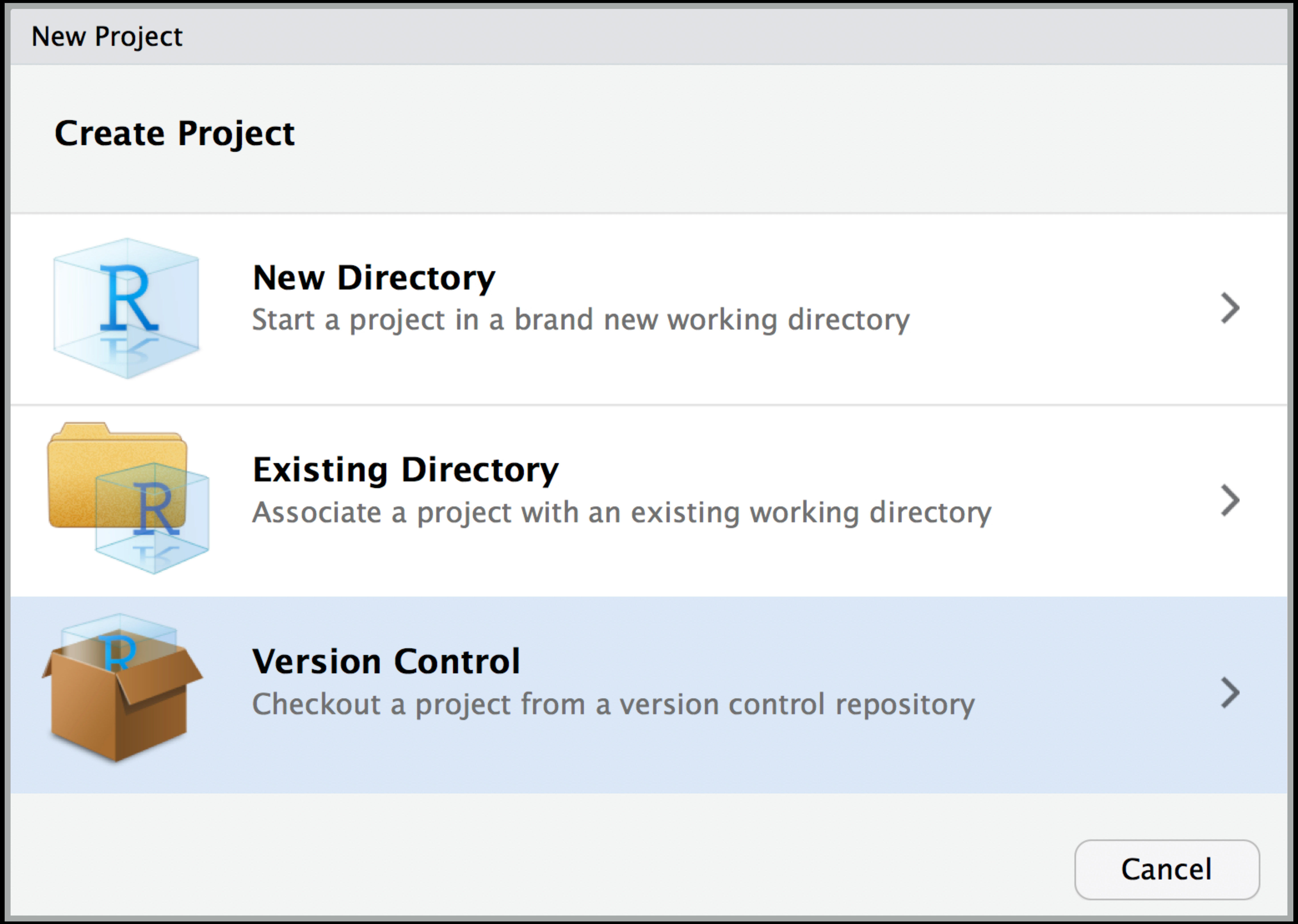
Use Git or checkout with SVN using the web URL.

```
https://github.com/bioboot/bimm143.gi
```

README.md

# bggn213

# RStudio > New Project > Version Control



New Project

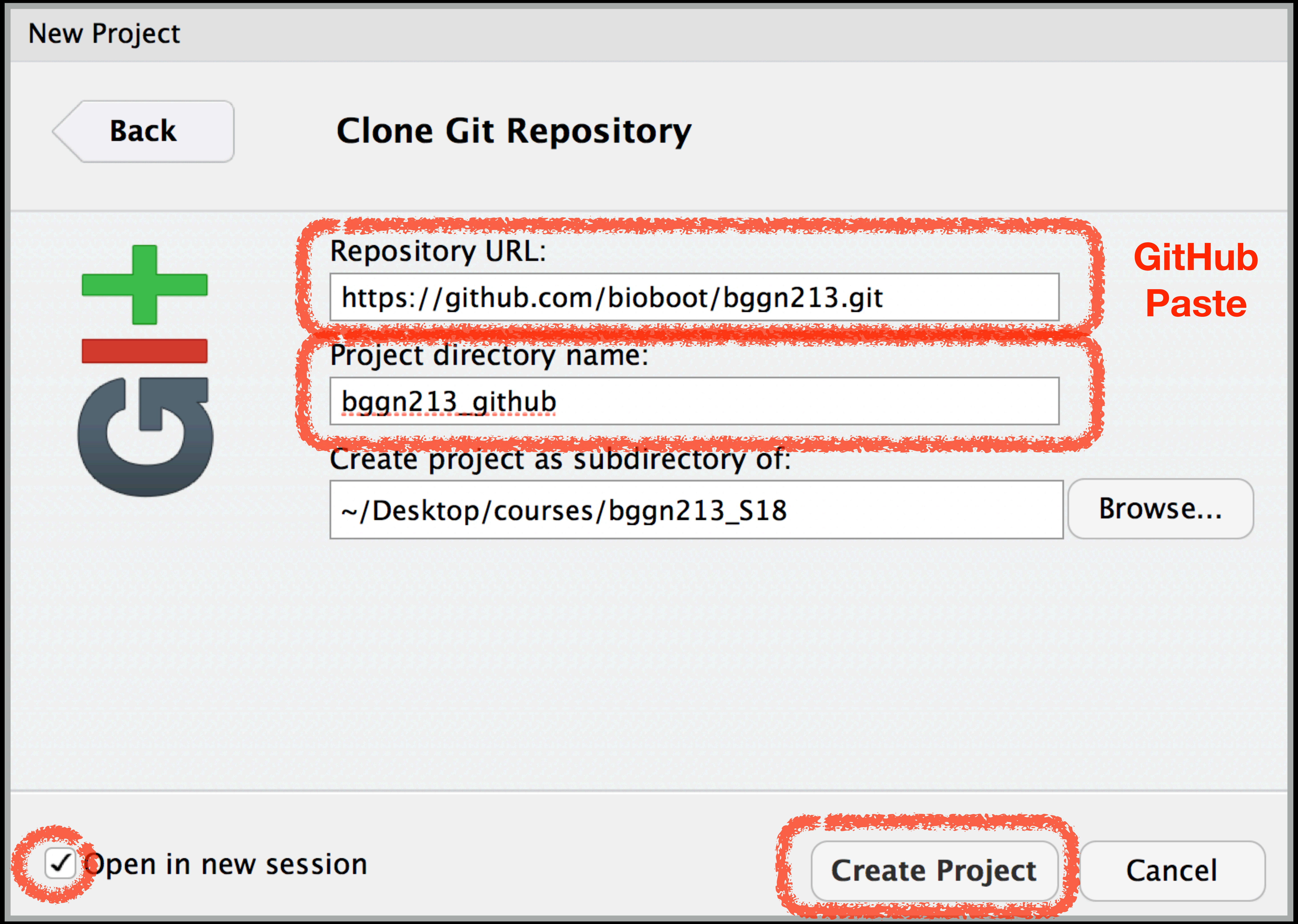
Create Project

New Directory
Start a project in a brand new working directory

Existing Directory
Associate a project with an existing working directory

Version Control
Checkout a project from a version control repository

# RStudio > New Project > Version Control



Repository URL: https://github.com/bioboot/bggn213.git

Project directory name: bggn213_github

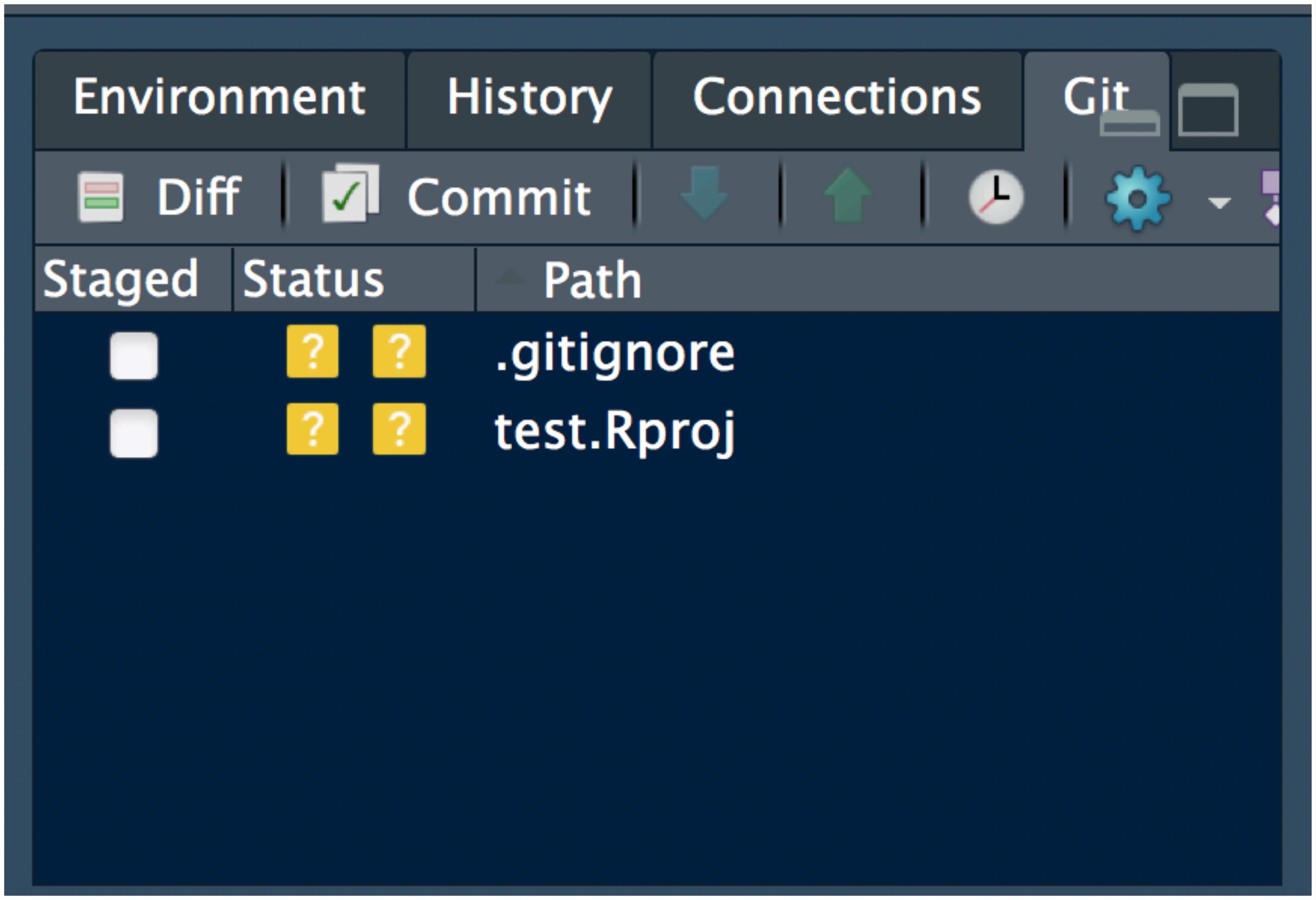
Create project as subdirectory of: ~/Desktop/courses/bggn213_S18

☑ Open in new session

GitHub Paste

# Demo of *editing, adding committing* and *pushing*

**Check if new Git tab Appears in RStudio?**

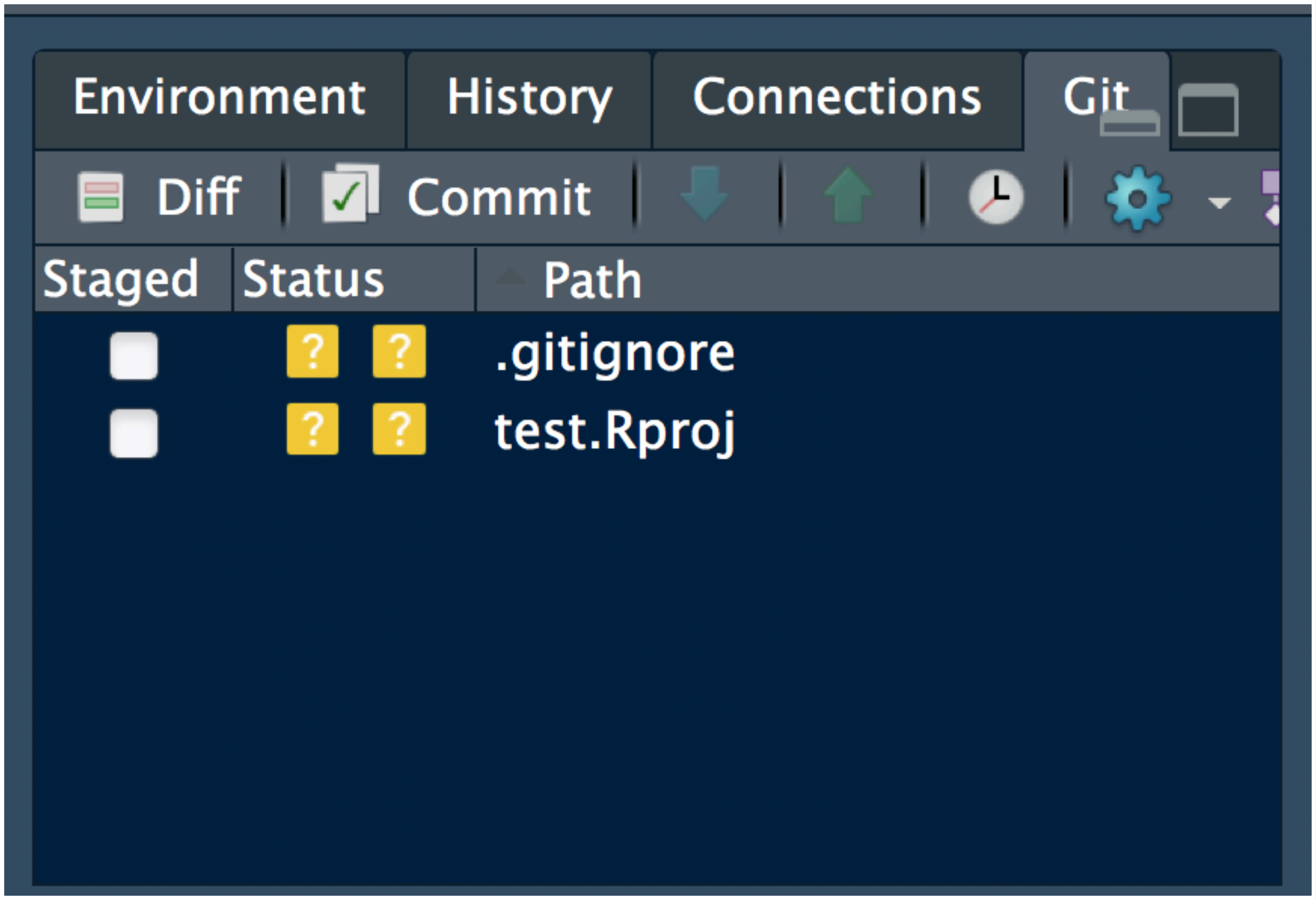


| Staged | Status | Path |
|---|---|---|
| □ | ? ? | .gitignore |
| □ | ? ? | test.Rproj |

**Now experiment editing the README.md file in RStudio and adding, committing and pushing changes to GitHub via this tab**

# Demo of *editing*, *adding* *committing* and *pushing*

**Check if new Git tab Appears in RStudio?**



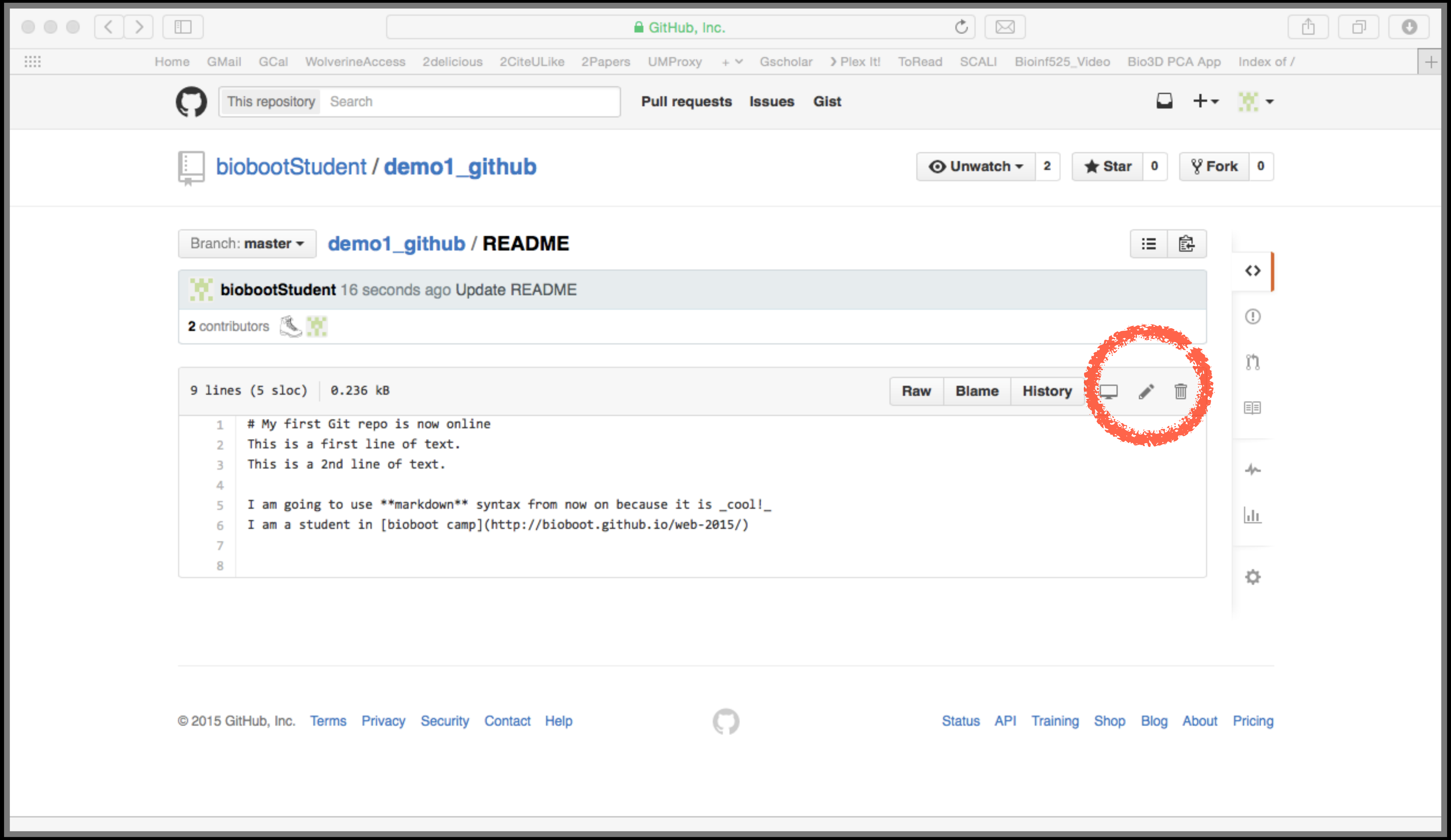
| Staged | Status | Path |
|---|---|---|
| ☐ | ? ? | .gitignore |
| ☐ | ? ? | test.Rproj |

**Now experiment editing the README.md file in RStudio and adding, committing and pushing changes to GitHub via this tab**

**When you are ready copy your different class directories/projects to this new GitHub tracked folder**

# **Side-note**: How to edit online

Specifically lets add some Markdown content



GitHub, Inc.
Home GMail GCal WolverineAccess 2delicious 2CiteULike 2Papers UMProxy Gscholar Plex It! ToRead SCALI Bioinf525_Video Bio3D PCA App Index of /
This repository Search
Pull requests Issues Gist
Unwatch 2 Star 0 Fork 0
Branch: master
Raw Blame History
© 2015 GitHub, Inc. Terms Privacy Security Contact Help
Status API Training Shop Blog About Pricing

biobootStudent / demo1_github

demo1_github / README

biobootStudent 16 seconds ago Update README

2 contributors

9 lines (5 sloc) | 0.236 kB

```
# My first Git repo is now online
This is a first line of text.
This is a 2nd line of text.

I am going to use **markdown** syntax from now on because it is _cool!_
I am a student in [bioboot camp](http://bioboot.github.io/web-2015/)


```

# Summary

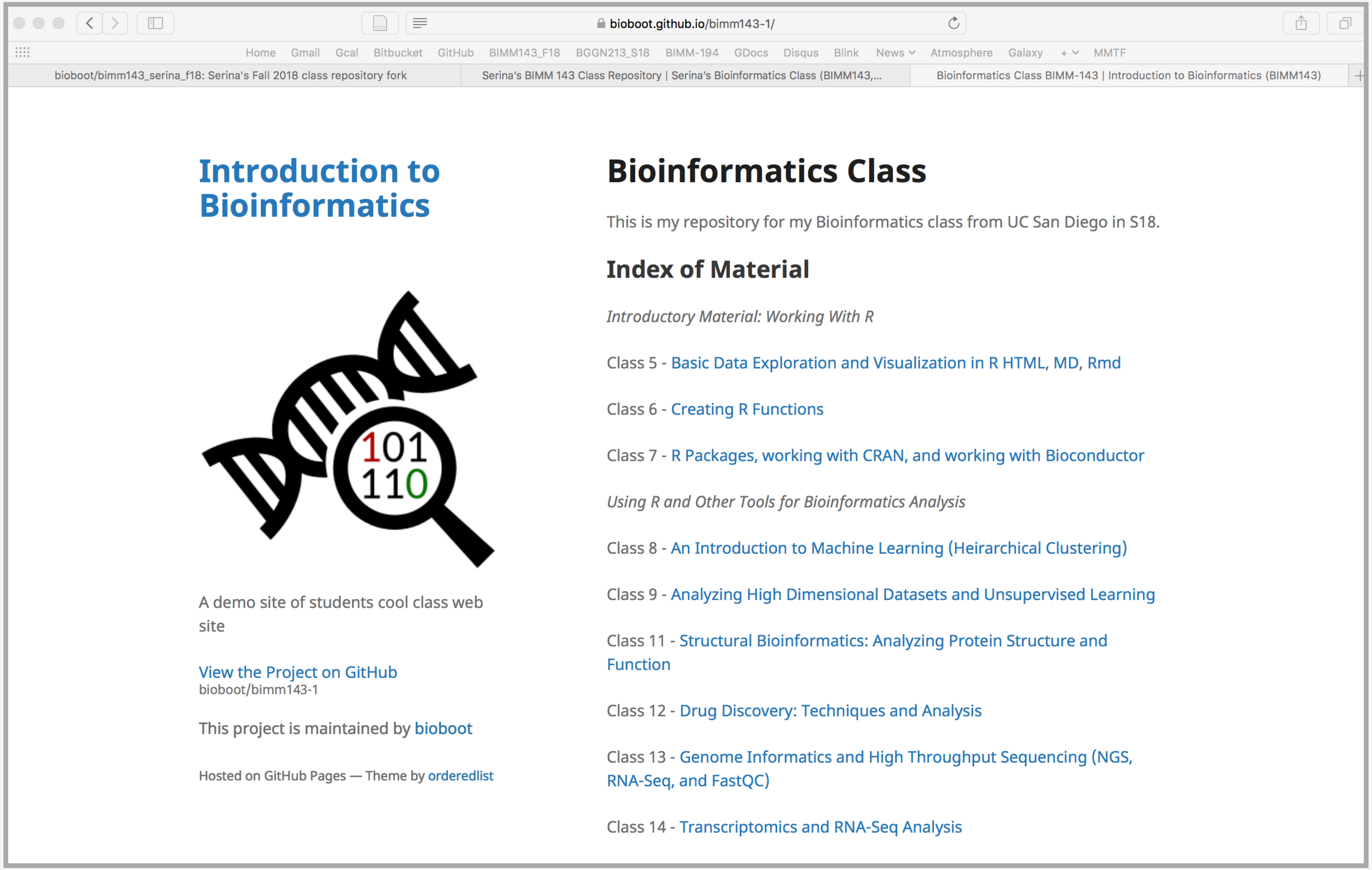
- Git is a popular ‘distributed’ version control system that is lightweight and free

- GitHub and BitBucket are popular hosting services for git repositories that have changed the way people contribute to open source projects

- Introduced basic git and GitHub usage within RStudio and encouraged you to adopt these ‘best practices’ for your future projects.

# Bonus:

# GitHub Spit & Polish


bioboot.github.io/bimm143-1/
Home
Gmail
Gcal
Bitbucket
GitHub
BIMM143_F18
BGGN213_S18
BIMM-194
GDocs
Disqus
Blink
News
Atmosphere
Galaxy
MMTF
bioboot/bimm143_serina_f18: Serina's Fall 2018 class repository fork
Serina's BIMM 143 Class Repository | Serina's Bioinformatics Class (BIMM143,...
Bioinformatics Class BIMM-143 | Introduction to Bioinformatics (BIMM143)
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This project is maintained by bioboot

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Class 12 - Drug Discovery: Techniques and Analysis

Class 13 - Genome Informatics and High Throughput Sequencing (NGS, RNA-Seq, and FastQC)

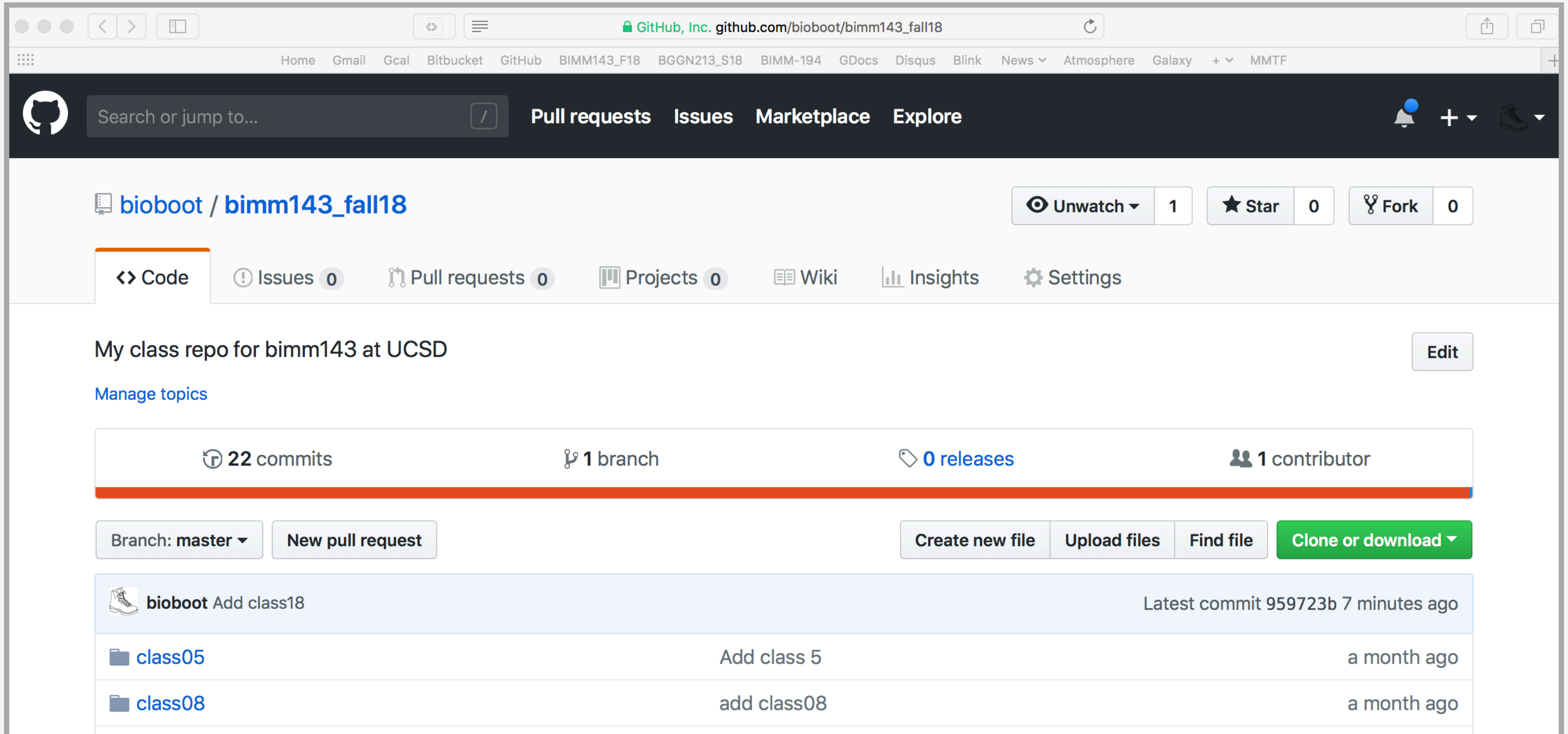
Class 14 - Transcriptomics and RNA-Seq Analysis

In your web browser navigate to your GitHub class repository < https://github.com/ >

**Side-note:**

To find the link to your GitHub repository from RStudio, open one of your past class projects and in the terminal type:

```
git remote -v
```



bioboot / bimm143_fall18

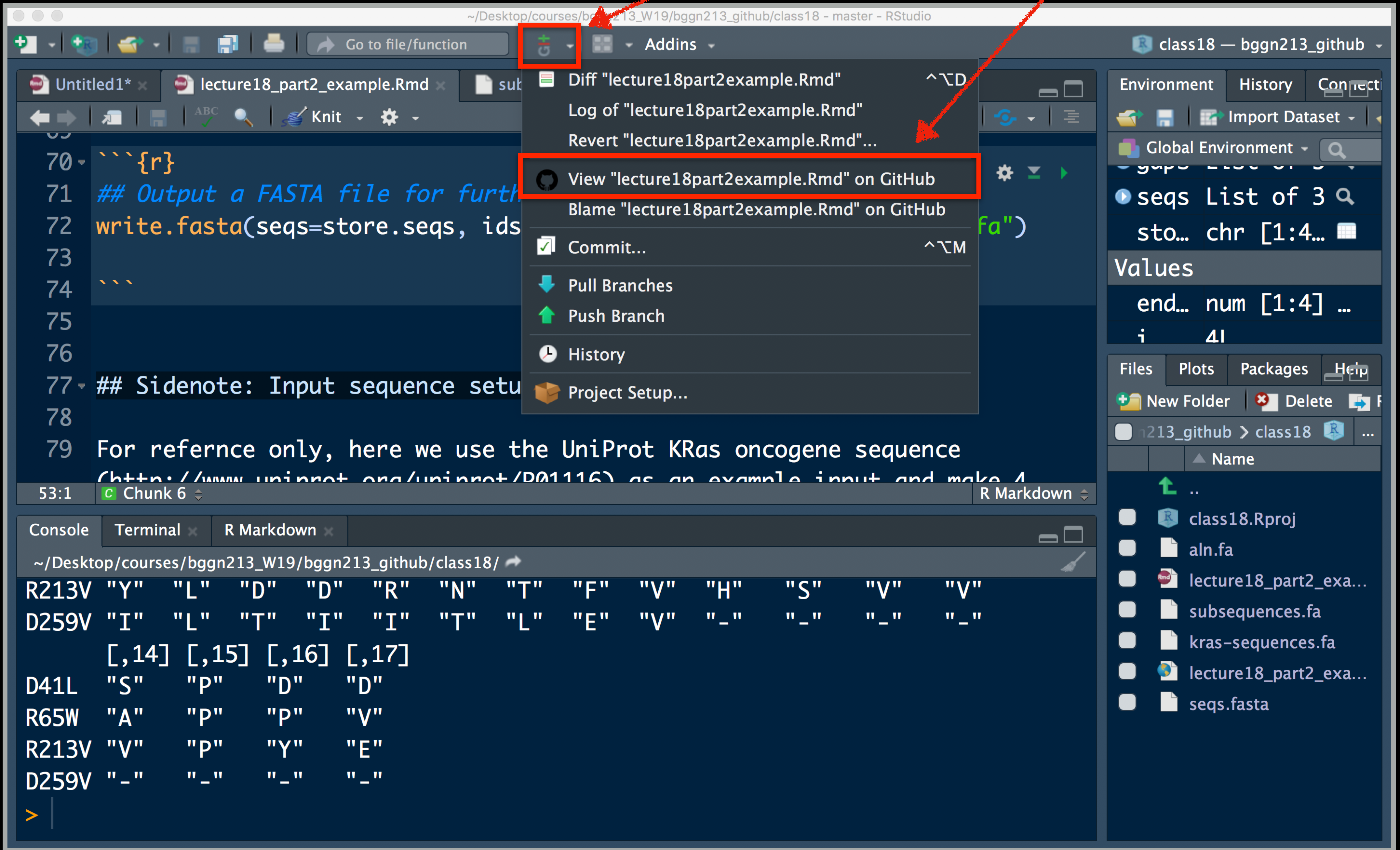
My class repo for bimm143 at UCSD

22 commits  1 branch  0 releases  1 contributor

bioboot Add class18 — Latest commit 959723b 7 minutes ago

| | | |
|---|---|---|
| class05 | Add class 5 | a month ago |
| class08 | add class08 | a month ago |

Or for a given GitHub tracked file click GIT icon and "VIEW on GITHUB"



~~~
```{r}
## Output a FASTA file for furth
write.fasta(seqs=store.seqs, ids                                    fa")

```


## Sidenote: Input sequence setu

For refernce only, here we use the UniProt KRas oncogene sequence
(http://www.uniprot.org/uniprot/P01116) as an example input and make 4
~~~

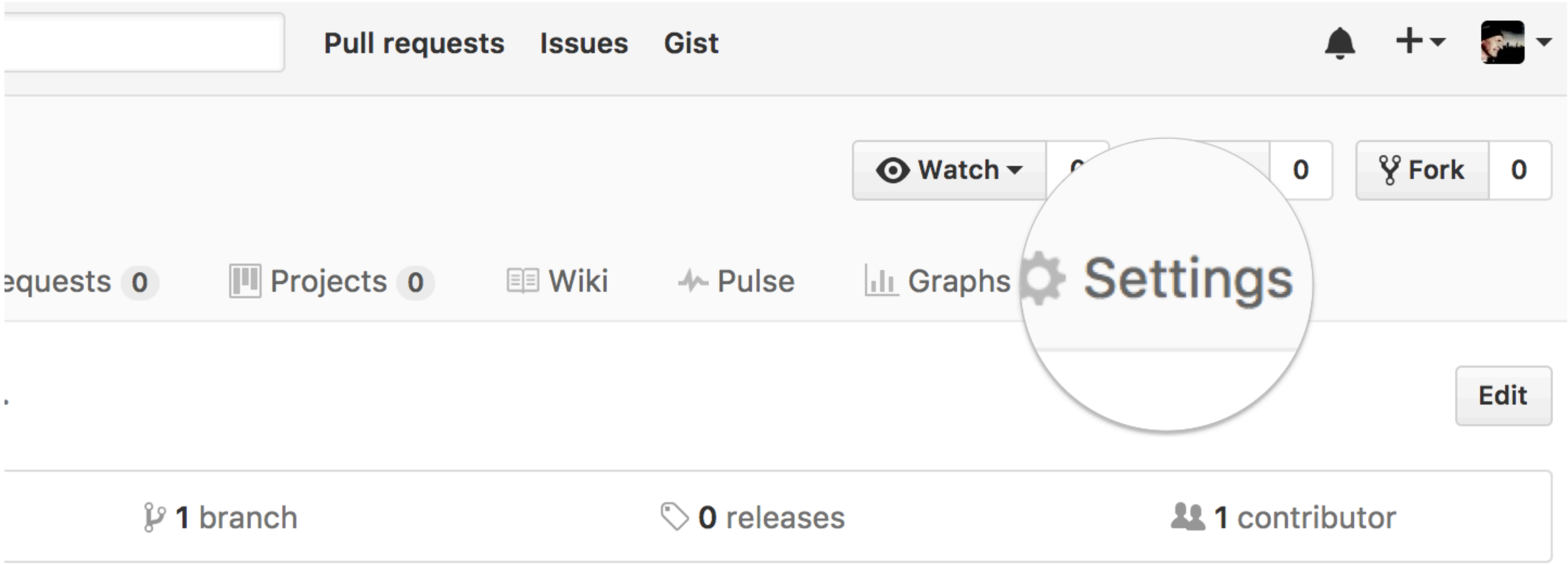
```
R213V "Y"  "L"  "D"  "D"  "R"  "N"  "T"  "F"  "V"  "H"   "S"   "V"   "V"
D259V "I"  "L"  "T"  "I"  "I"  "T"  "L"  "E"  "V"  "-"   "-"   "-"   "-"
      [,14] [,15] [,16] [,17]
D41L  "S"   "P"   "D"   "D"
R65W  "A"   "P"   "P"   "V"
R213V "V"   "P"   "Y"   "E"
D259V "-"   "-"   "-"   "-"
>
```

1

# Repository Settings

**Head over to your GitHub class repository (where you are “pushing” all your class work)**

**Click on the Settings tab.**

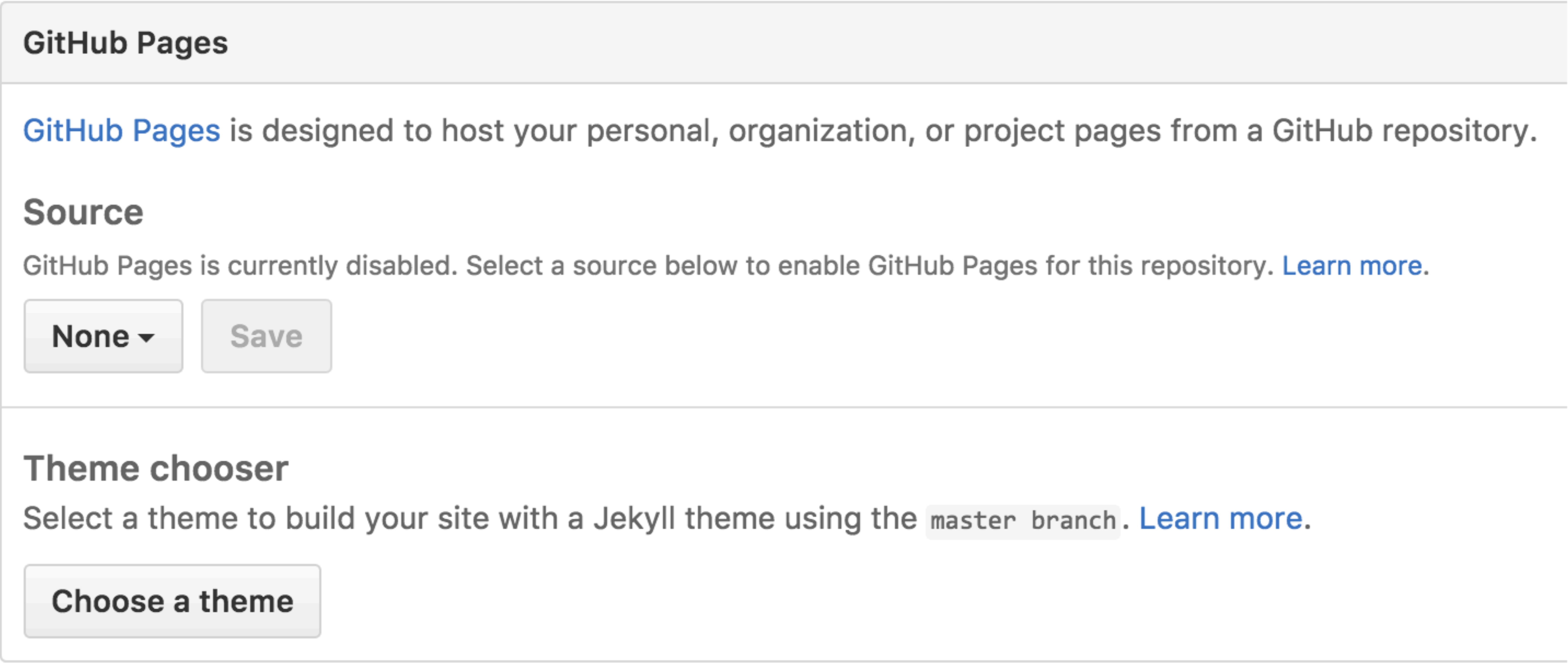


2

# Theme chooser

Scroll down to the **GitHub Pages** section. ~~Press **Choose a theme**.~~

**And set the Source to “main branch"**



GitHub Pages

GitHub Pages is designed to host your personal, organization, or project pages from a GitHub repository.

Source

GitHub Pages is currently disabled. Select a source below to enable GitHub Pages for this repository. Learn more.

Theme chooser

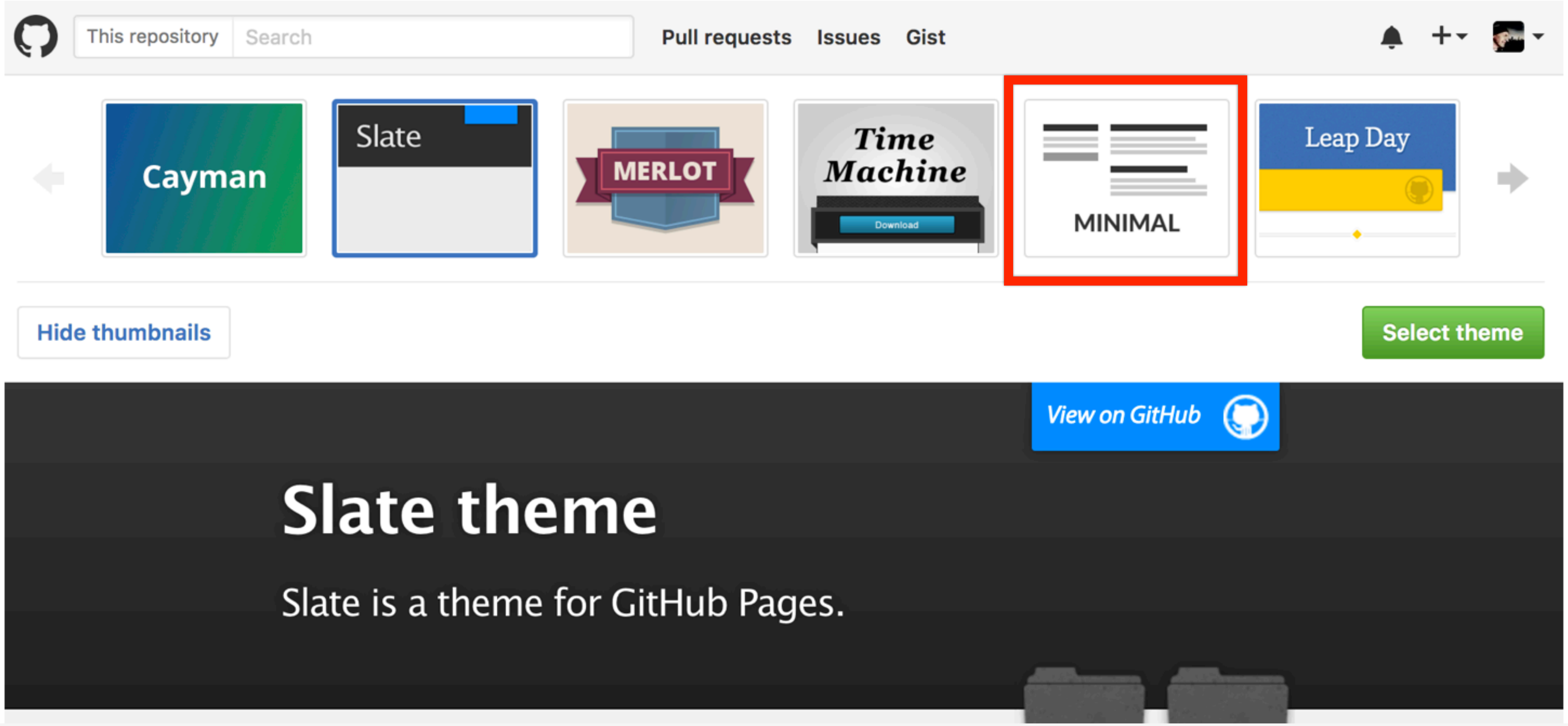
Select a theme to build your site with a Jekyll theme using the `master branch`. Learn more.

3

# Pick a theme

Choose one of the themes from the carousel at the top.

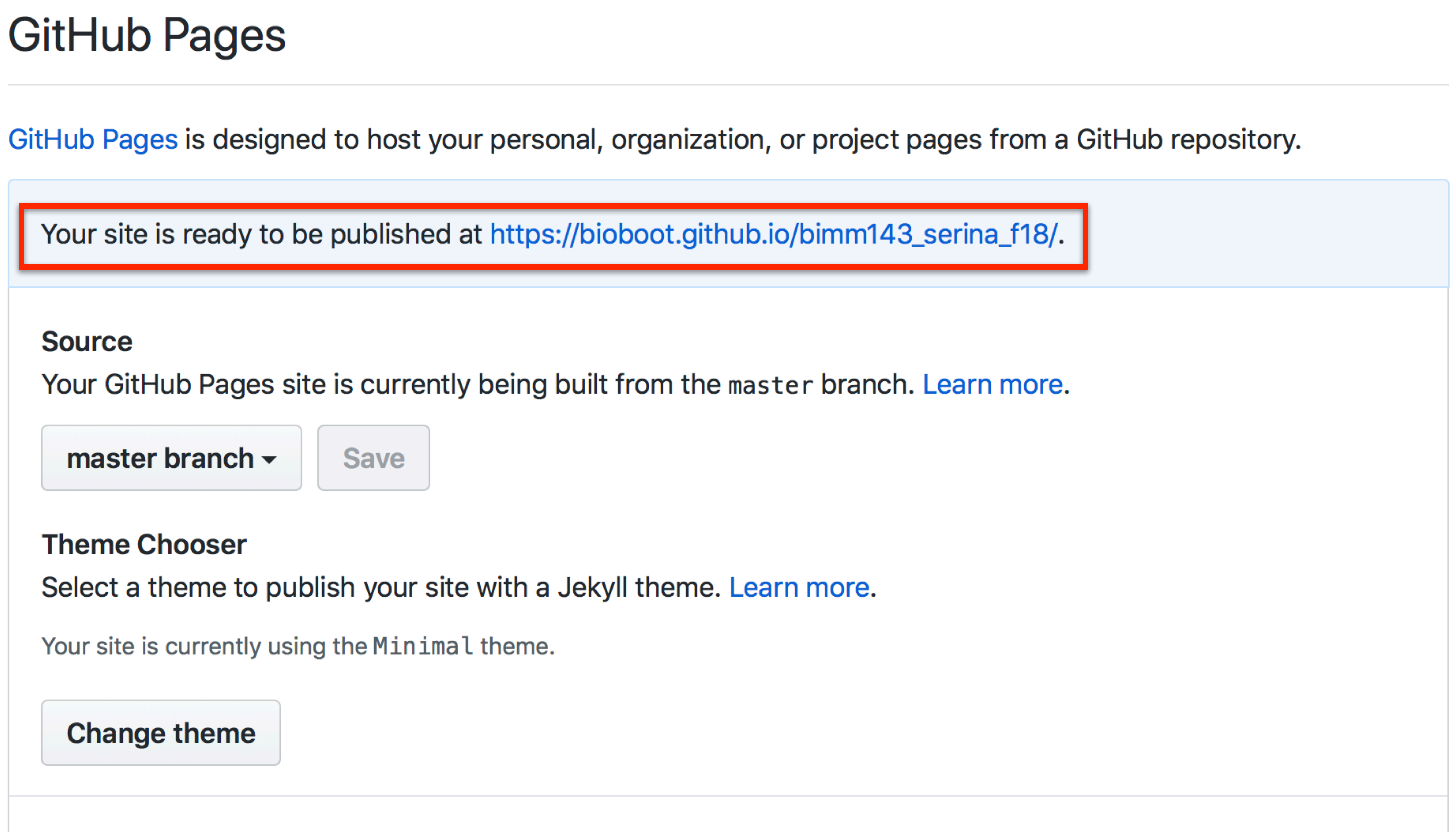
When you're done, click **Select theme** on the right.



4

# Side-note:

**Scroll down again to the GitHub Pages section to find the link to your new website. Open this link in a New Tab of your browser:**



## GitHub Pages

GitHub Pages is designed to host your personal, organization, or project pages from a GitHub repository.

Your site is ready to be published at https://bioboot.github.io/bimm143_serina_f18/.

**Source**

Your GitHub Pages site is currently being built from the `master` branch. Learn more.

**Theme Chooser**

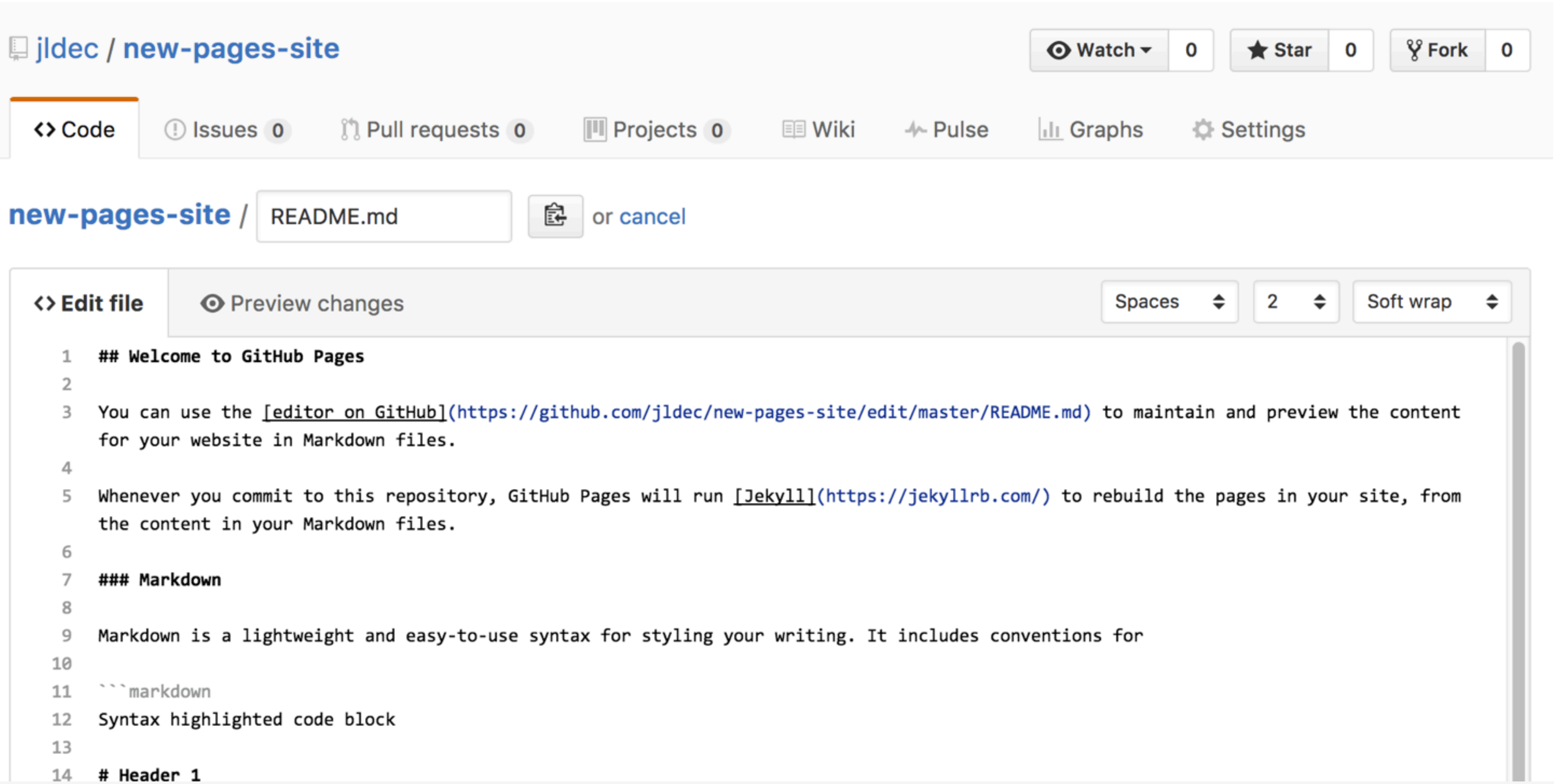
Select a theme to publish your site with a Jekyll theme. Learn more.

Your site is currently using the `Minimal` theme.

4

# Edit content

**Back on the repository main page use the GitHub online editor to add content. In particular, add links to each classes .MD file**

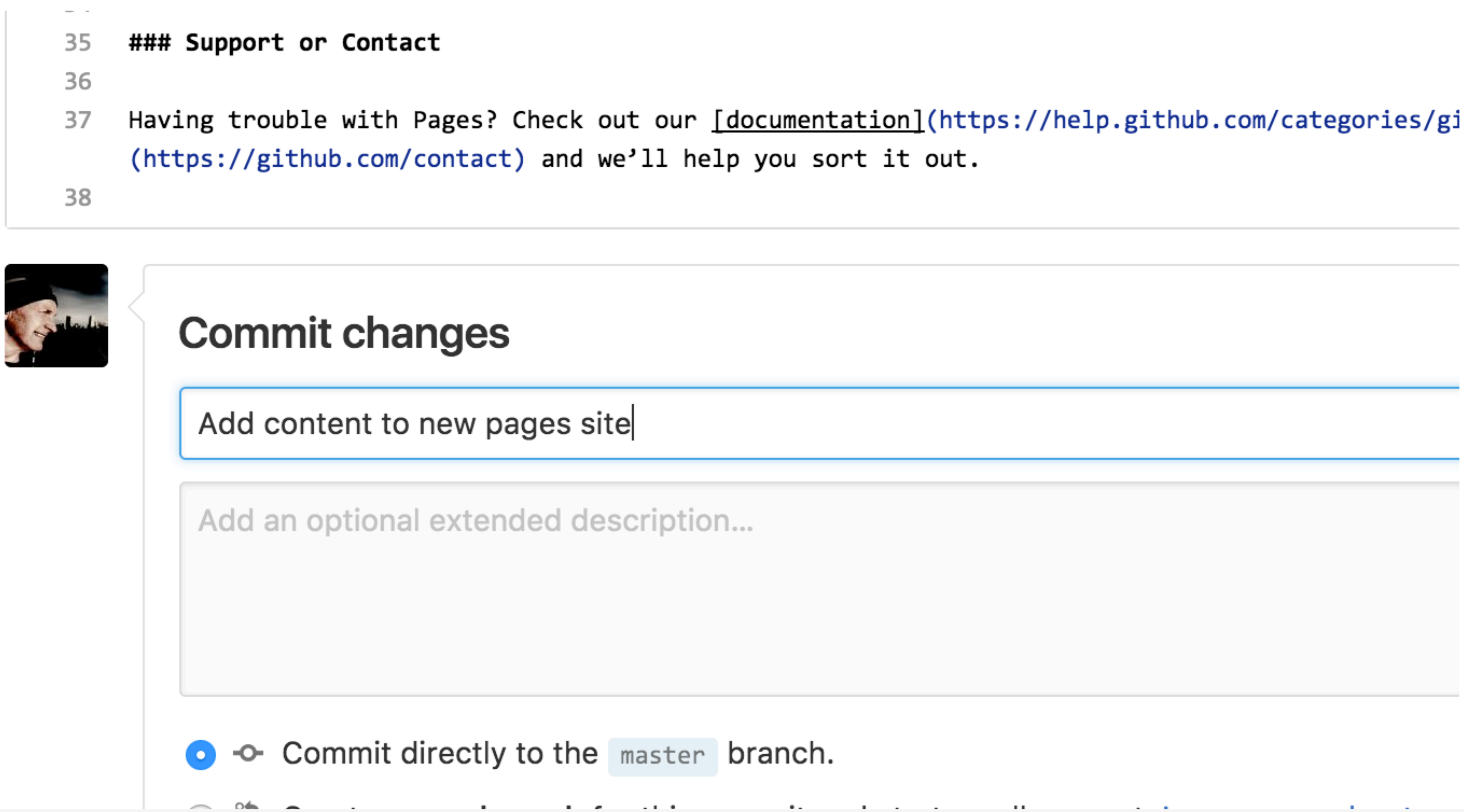


~~~
## Welcome to GitHub Pages

You can use the [editor on GitHub](https://github.com/jldec/new-pages-site/edit/master/README.md) to maintain and preview the content for your website in Markdown files.

Whenever you commit to this repository, GitHub Pages will run [Jekyll](https://jekyllrb.com/) to rebuild the pages in your site, from the content in your Markdown files.

### Markdown

Markdown is a lightweight and easy-to-use syntax for styling your writing. It includes conventions for

```markdown
Syntax highlighted code block

# Header 1
~~~

5

# Commit

Enter a commit comment and click on **Commit changes** below the editor.



```
### Support or Contact

Having trouble with Pages? Check out our [documentation](https://help.github.com/categories/gi
(https://github.com/contact) and we’ll help you sort it out.

```

**Commit changes**

Add content to new pages site

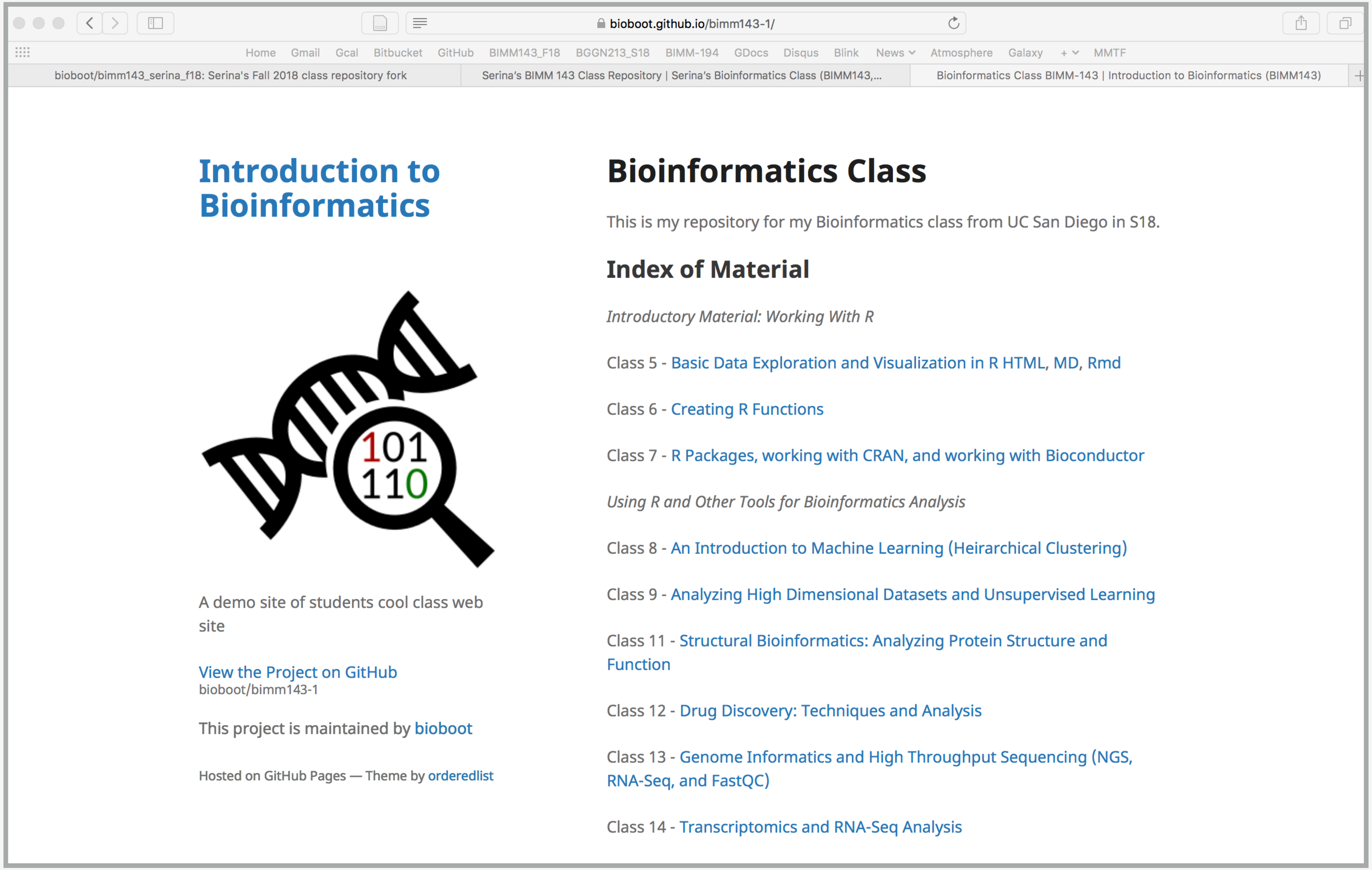
Add an optional extended description…

● Commit directly to the `master` branch.

6

# …and you're done!

Fire up a browser and go to **http://*username*.github.io/*repository***.


bioboot.github.io/bimm143-1/
Home
Gmail
Gcal
Bitbucket
GitHub
BIMM143_F18
BGGN213_S18
BIMM-194
GDocs
Disqus
Blink
News
Atmosphere
Galaxy
MMTF
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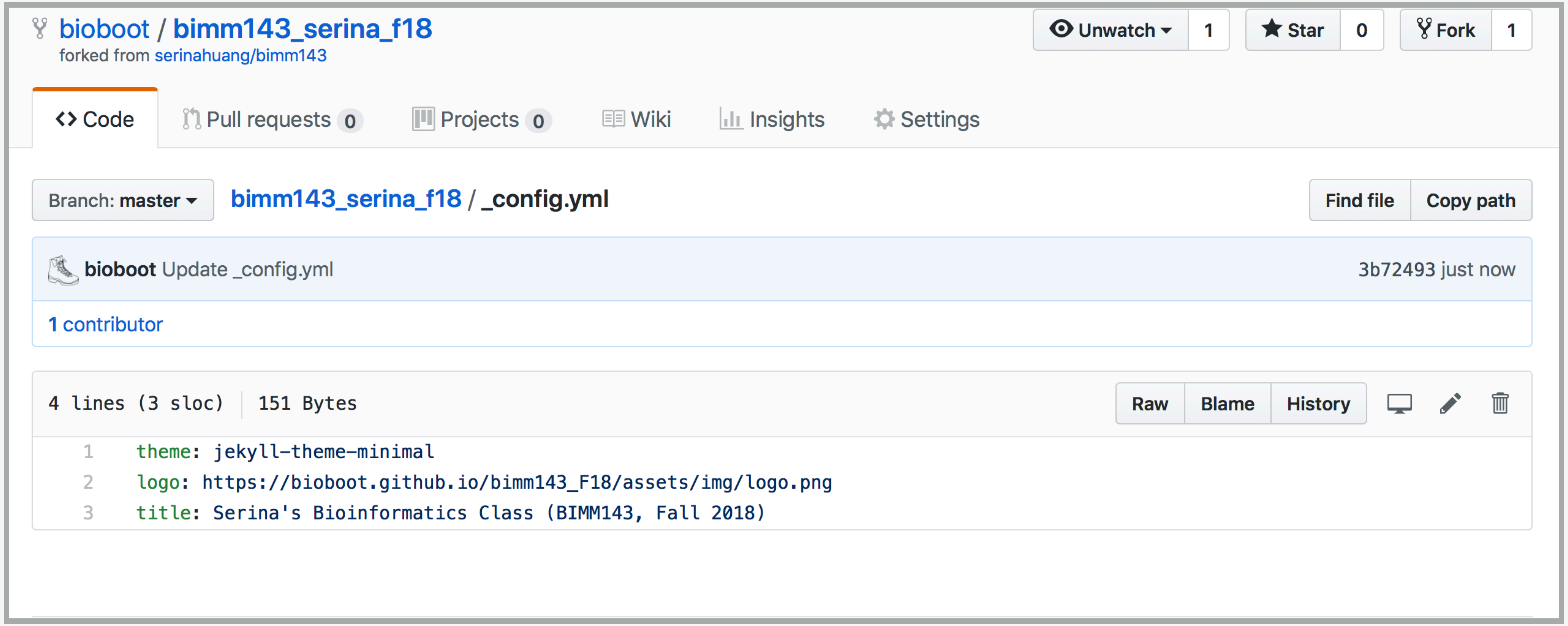
Class 14 - Transcriptomics and RNA-Seq Analysis

**Here I: (1) forked Serina's Repo, (2) Chose the "minimal" theme, (3) Edited _config.yml (adding logo and title)**



bioboot / bimm143_serina_f18

forked from serinahuang/bimm143

bimm143_serina_f18 / _config.yml

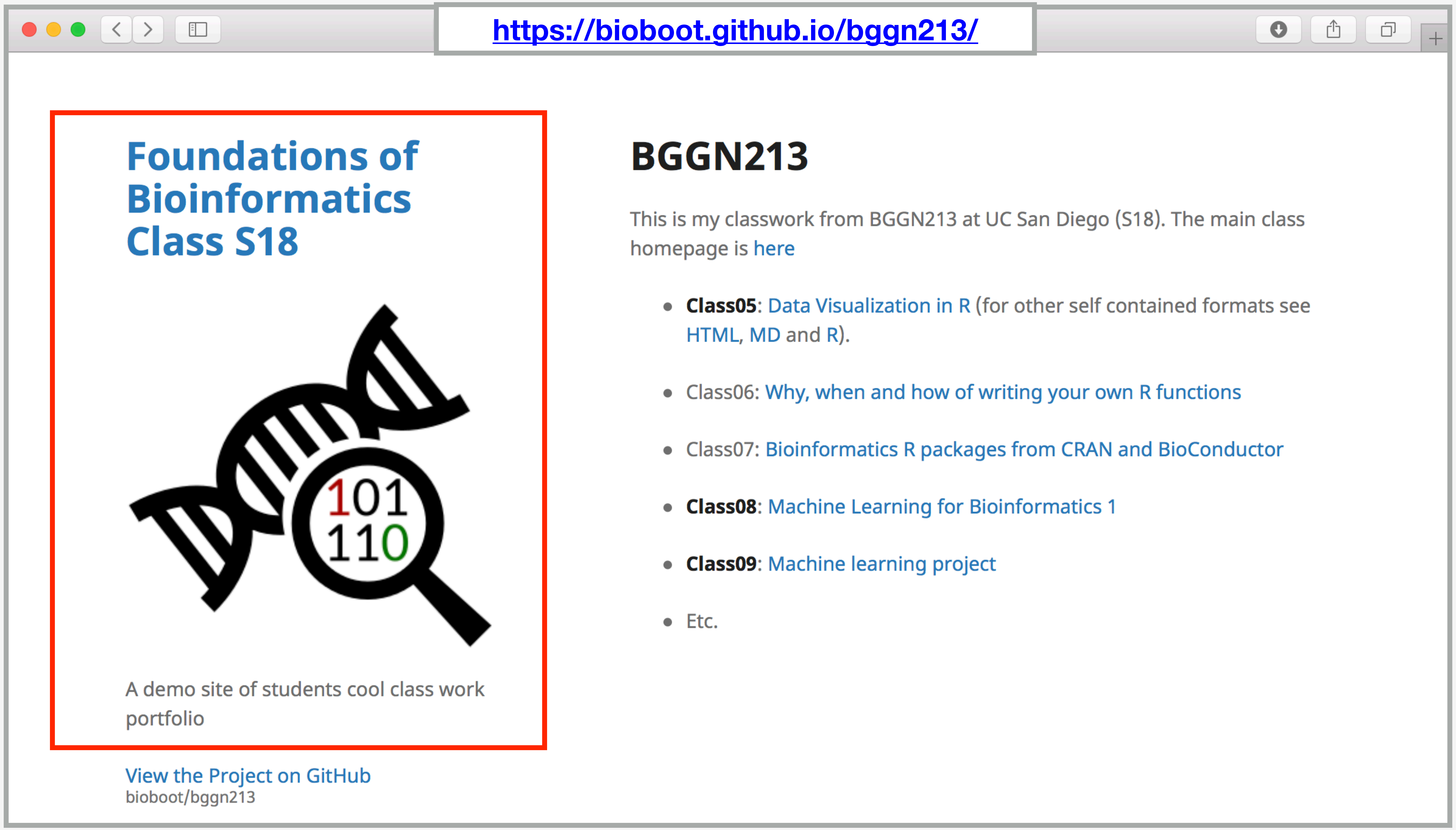
bioboot Update _config.yml 3b72493 just now

1 contributor

4 lines (3 sloc) | 151 Bytes

```
theme: jekyll-theme-minimal
logo: https://bioboot.github.io/bimm143_F18/assets/img/logo.png
title: Serina's Bioinformatics Class (BIMM143, Fall 2018)
```

Here I: (1) Chose the “minimal” theme, (3) Edited _config.yml (adding logo and title), (4) Edited README.md



https://bioboot.github.io/bggn213/

# Foundations of Bioinformatics Class S18

A demo site of students cool class work portfolio

View the Project on GitHub
bioboot/bggn213

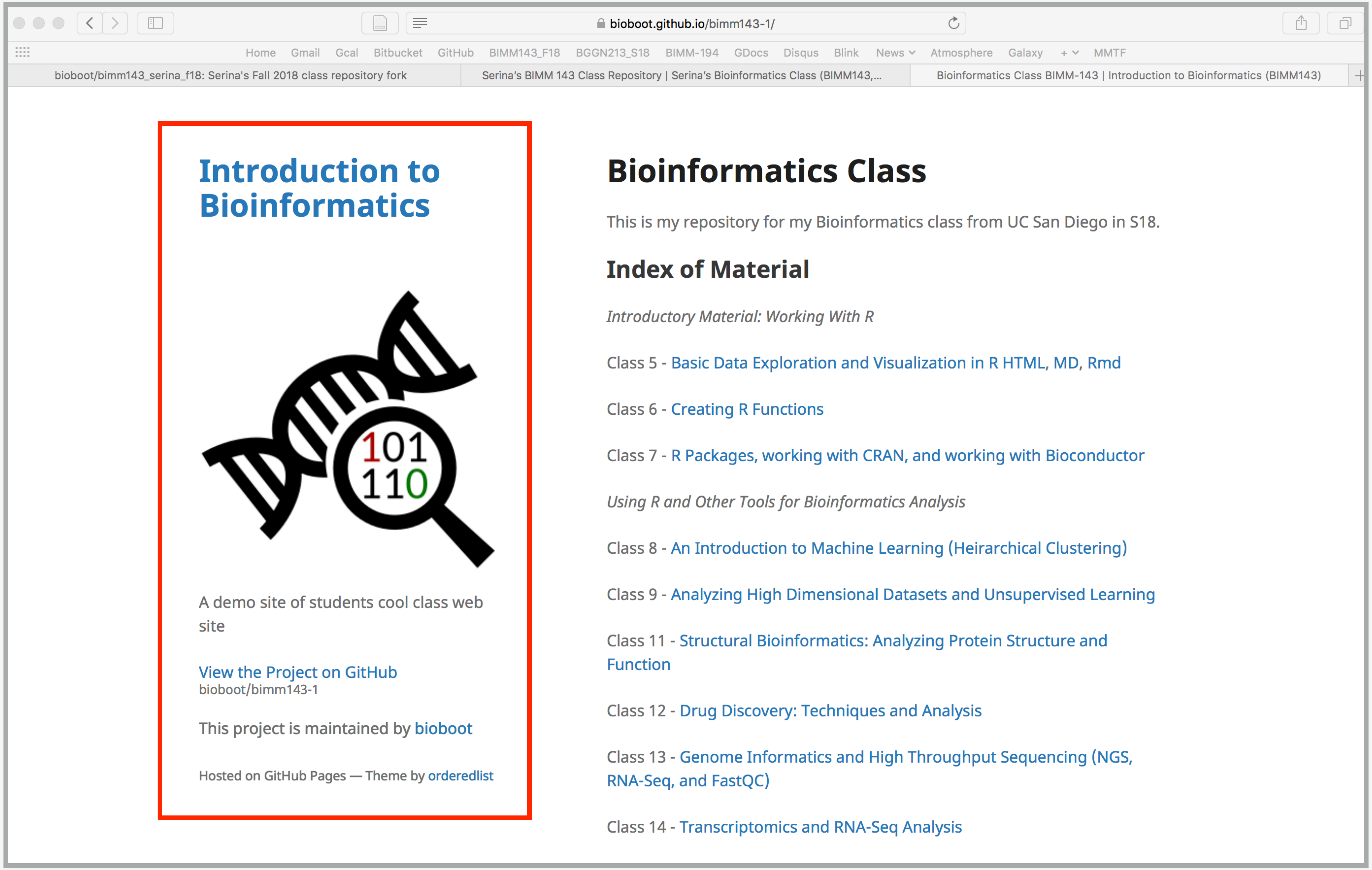
## BGGN213

This is my classwork from BGGN213 at UC San Diego (S18). The main class homepage is here

- **Class05**: Data Visualization in R (for other self contained formats see HTML, MD and R).
- Class06: Why, when and how of writing your own R functions
- Class07: Bioinformatics R packages from CRAN and BioConductor
- **Class08**: Machine Learning for Bioinformatics 1
- **Class09**: Machine learning project
- Etc.

Here I: (1) Chose the "minimal" theme, (3) Edited _config.yml (adding logo and title), (4) Edited README.md

https://bioboot.github.io/tmp_test/


bioboot.github.io/bimm143-1/
Home Gmail Gcal Bitbucket GitHub BIMM143_F18 BGGN213_S18 BIMM-194 GDocs Disqus Blink News Atmosphere Galaxy + MMTF
bioboot/bimm143_serina_f18: Serina's Fall 2018 class repository fork
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Bioinformatics Class BIMM-143 | Introduction to Bioinformatics (BIMM143)
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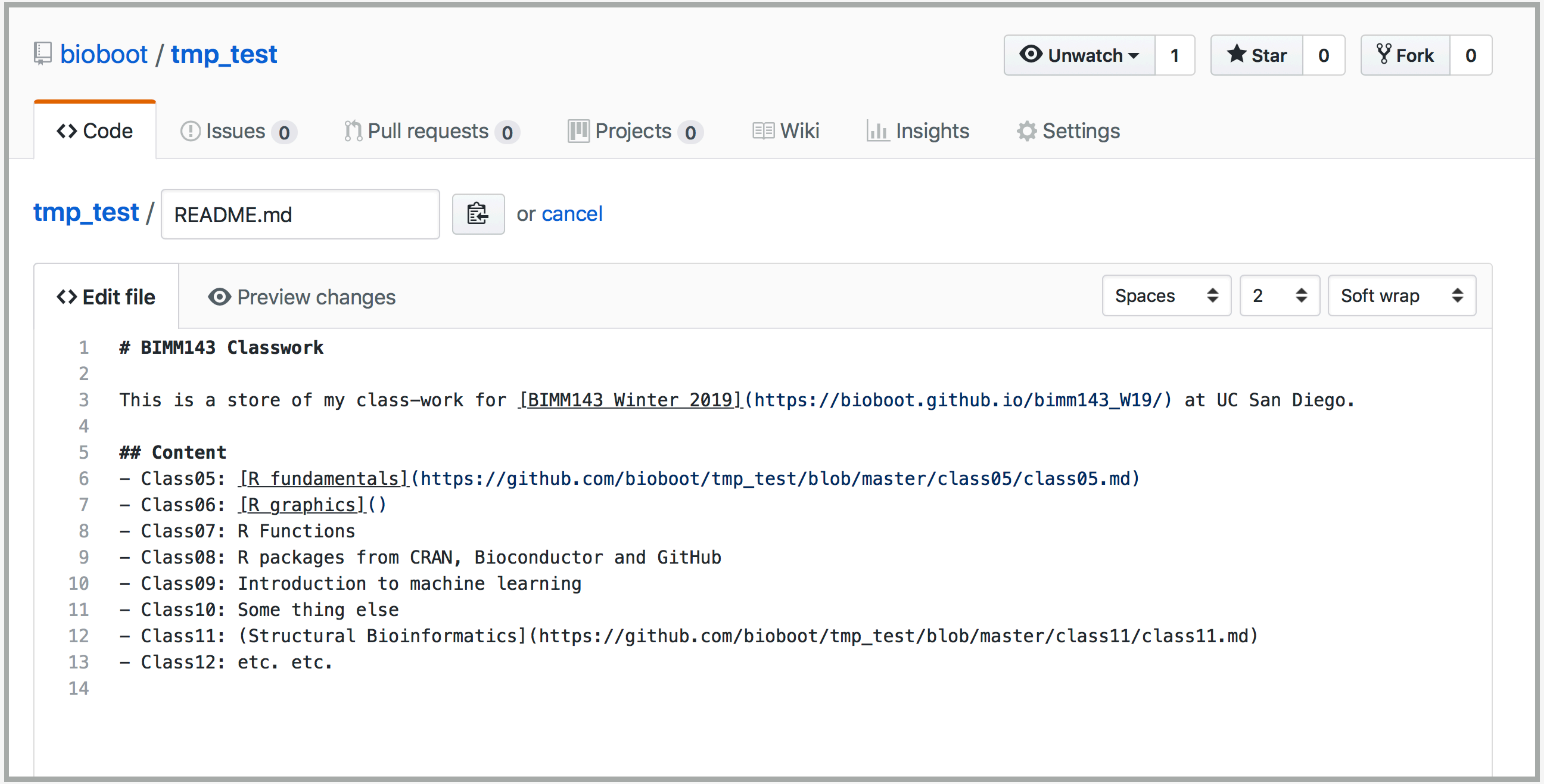
**Here I: (1) Chose the "minimal" theme, (3) Edited _config.yml (adding logo and title), (4) Edited README.md**



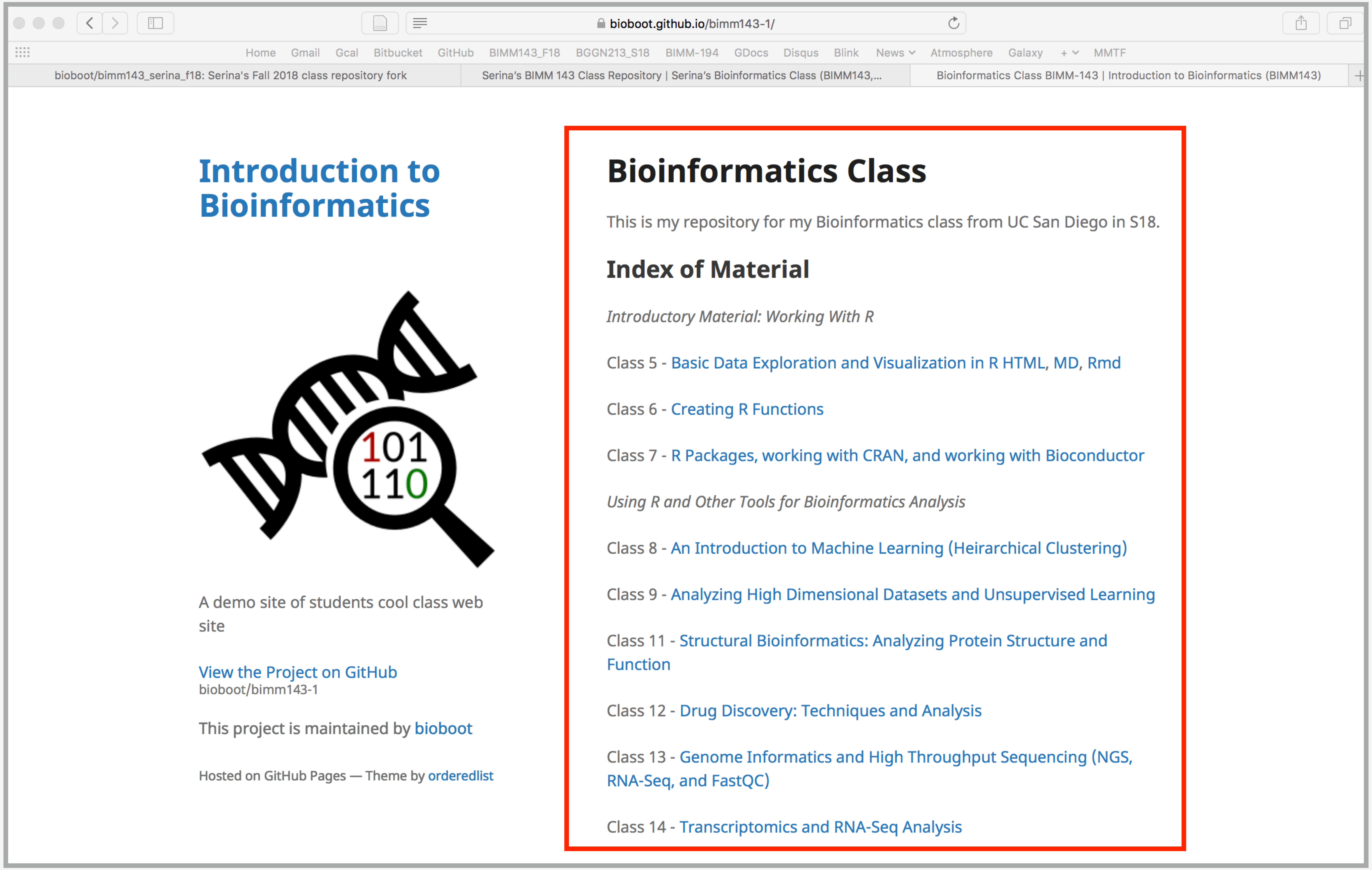
```
# BIMM143 Classwork

This is a store of my class-work for [BIMM143 Winter 2019](https://bioboot.github.io/bimm143_W19/) at UC San Diego.

## Content
- Class05: [R fundamentals](https://github.com/bioboot/tmp_test/blob/master/class05/class05.md)
- Class06: [R graphics]()
- Class07: R Functions
- Class08: R packages from CRAN, Bioconductor and GitHub
- Class09: Introduction to machine learning
- Class10: Some thing else
- Class11: (Structural Bioinformatics](https://github.com/bioboot/tmp_test/blob/master/class11/class11.md)
- Class12: etc. etc.

```

**Here I: (1) Chose the “minimal” theme, (3) Edited _config.yml (adding logo and title), (4) Edited README.md**


bioboot.github.io/bimm143-1/
Home Gmail Gcal Bitbucket GitHub BIMM143_F18 BGGN213_S18 BIMM-194 GDocs Disqus Blink News Atmosphere Galaxy + MMTF
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# Thank you very much!

**Please do fill out your CAPs evaluation ( Link! ) if you get a change.**
**It is important to the courses we offer in the future and how we teach them!**

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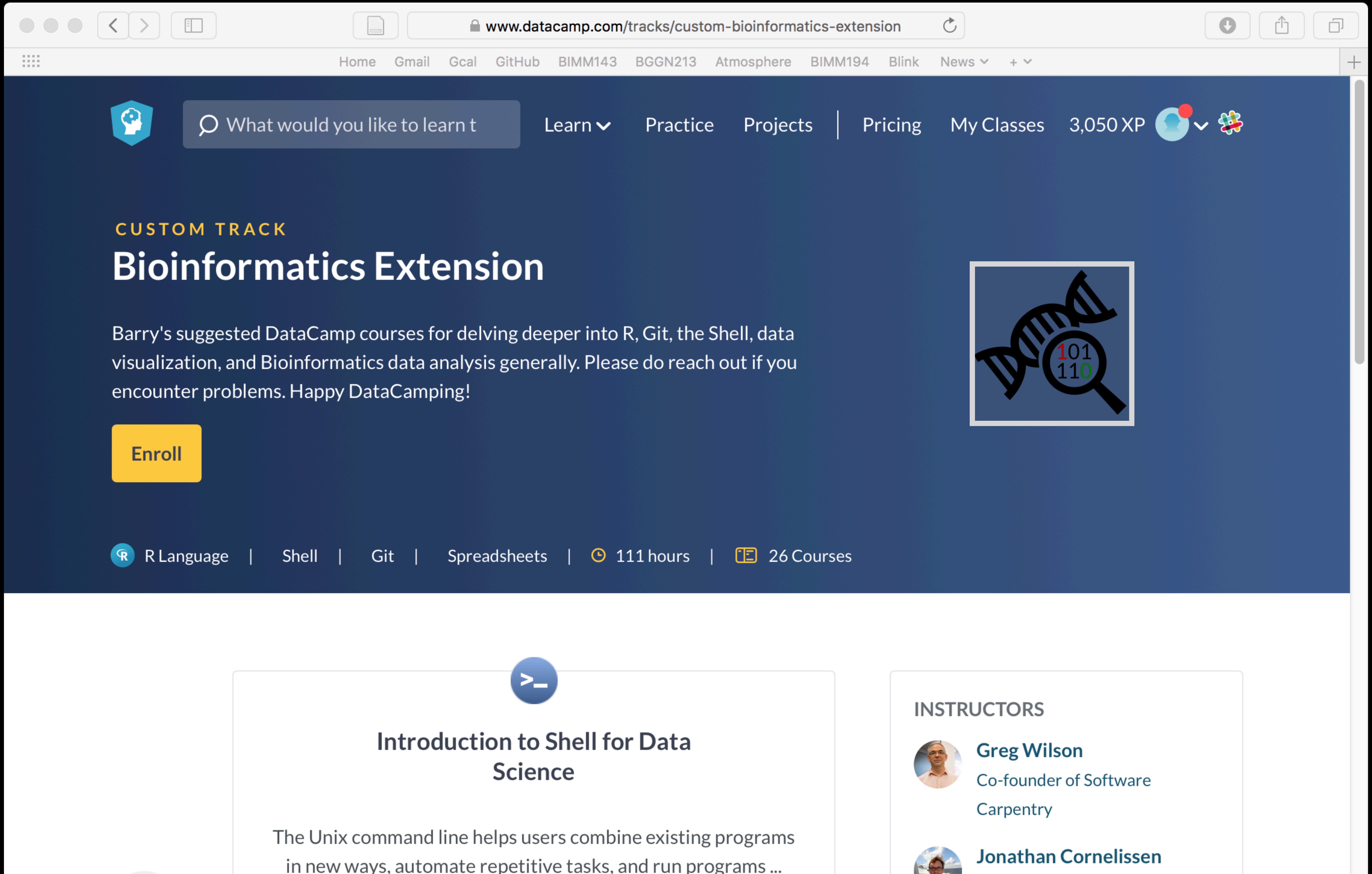
# Going Further With DataCamp

https://bioboot.github.io/bimm143_F19/class-material/datacamp_extras.pdf



CUSTOM TRACK

## Bioinformatics Extension

Barry's suggested DataCamp courses for delving deeper into R, Git, the Shell, data visualization, and Bioinformatics data analysis generally. Please do reach out if you encounter problems. Happy DataCamping!

Enroll

R Language | Shell | Git | Spreadsheets | 111 hours | 26 Courses

### Introduction to Shell for Data Science

The Unix command line helps users combine existing programs in new ways, automate repetitive tasks, and run programs ...

INSTRUCTORS

Greg Wilson
Co-founder of Software Carpentry

Jonathan Cornelissen

# Thank you very much!

**Please do fill out your CAPs evaluation ( Link! ) if you get a change.**
**It is important to the courses we offer in the future and how we teach them!**

**Post to GradeScope your GitHub Pages portfolio URL with all classes by this Friday and receive another 5pts credit!**

Announcement!

# Bonus:

# Bioinformatics & Genomics in Industry

## Live Stream Video

Enjoy a set of short open ended guest lectures from leading genomic scientists at **Illumina Inc.**, **Synthetic Genomics Inc.**, and the **La Jolla Institute for Allergy and Immunology**. Feel free to contact these scientists for networking and to have your questions about industry careers in Bioinformatics and Genomics answered.

# Learning git can be painful!

However in practice it is not nearly as crazy-making as the alternatives:

- Documents as email attachments
- Hair-raising ZIP archives containing file salad
- Am I working with the most recent data?
- Archaelogical “digs” on old email threads  and uncertainty about how/if certain changes have been made or issues solved

Finally Please remember that **GitHub** and **BitBucket** are **PUBLIC** and that you should cultivate your professional and scholarly profile with intention!

# The End!

http://thegrantlab.org

# Thank You!

http://thegrantlab.org

# Reference Slides

Command Line GIT

# Using Command Line Git

1. Initiate a Git repository.
2. Edit content (i.e. change some files).
3. Store a ‘snapshot’ of the current file state.*

**Initiate** a Git repository

Do it Yourself!

# **Initiate** a Git repository

```
> cd ~/Desktop
> mkdir git_class      # Make a new directory
> cd git_class         # Change to this directory
> git init             # Our first Git command!
> ls -a                # what happened?
```

# Side-Note: The .git/ directory

- Git created a ‘hidden’ **.git/** directory inside your current working directory.

- You can use the ‘**ls -a**’ command to list (*i.e.* see) this directory and its contents.

- This is where Git stores all its goodies - **this is Git!**

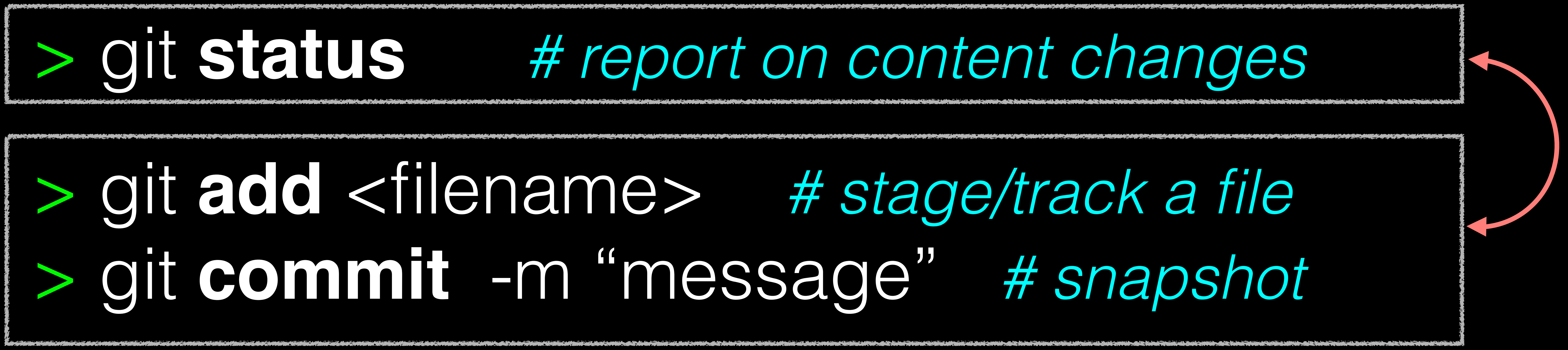
- You should not need to edit the contents of the **.git** directory for now but do feel free to poke around.

# Important Git commands

```
> git status      # report on content changes
```

```
> git add <filename>     # stage/track a file
> git commit  -m “message”    # snapshot
```

# Important Git commands



```
> git status                      # report on content changes
```

```
> git add <filename>     # stage/track a file
> git commit -m "message"   # snapshot
```

*You will use these three commands again and again in your Git workflow!*

# Git TRACKS your directory content

- To get a report of changes (since last commit) use:

```
> git status
```

- You tell Git which files to track with:

```
> git add <filename>
```

This adds files to a so called **STAGING AREA** (akin to a “shopping cart” before purchasing).

- You tell Git when to take an historical **SNAPSHOT** of your staged files (*i.e.* record their current state) with:

```
>   git commit -m ‘Your message about changes’
```

# Example Git workflow

Eva creates a README text file
(this starts as untracked)

Adds file to STAGING AREA*
(tracked and ready to take a snapshot)

Commit changes*
(records snapshot of staged files!)

Hands on example!

# Example Git workflow

Eva creates a README text file

Adds file to STAGING AREA*

Commit changes*

Eva modifies README and adds a ToDo text file

Adds both to STAGING AREA*

Commit changes*

Do it Yourself!

# 1. Eva creates a README file

```
> # cd ~/Desktop/git_class
> # git init

> echo "This is a first line of text." > README
> git status          # Report on changes
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#     README
#
# nothing added to commit but untracked files present (use "git add" to track)
```

# 2. Adds to ‘staging area’

```
> git add README      # Add README file to staging area
> git status          # Report on changes

# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#     new file:   README
#
```

# 3. Commit changes

```
> git commit -m “Create a README file”     # Take snapshot
# [master (root-commit) 8676840] Create a README file
#  1 file changed, 1 insertion(+)
#  create mode 100644 README


> git status                    # Report on changes
# On branch master
# nothing to commit, working directory clean
```

# 4. Eva modifies README file and adds a ToDo file

```
> echo "This is a 2nd line of text." >> README
> echo "Learn git basics" >> ToDo

> git status          # Report on changes
# On branch master
#
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#     modified:   README
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#     ToDo
#
# no changes added to commit (use "git add" and/or "git commit -a")
```

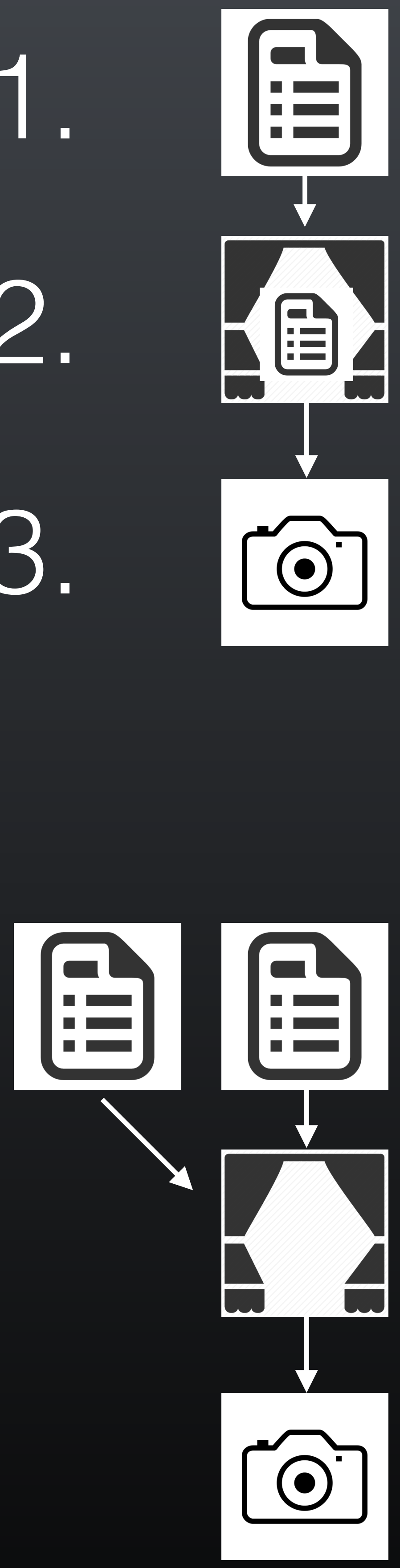
# 5. Adds both files to ‘staging area’

```
> git add README ToDo     # Add both files to ‘staging area’
> git status              # Report on changes

# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#     modified:   README
#      new file:   ToDo
#
```

# 6. Commits changes

```
> git commit -m "Add ToDo and modify README"
# [master 7b679fa] Add ToDo and modify README
#  2 files changed, 2 insertions(+)
#  create mode 100644 ToDo

> git status
# On branch master
# nothing to commit, working directory clean
```

# Example Git workflow



1. Eva creates a README text file
2. Adds file to STAGING AREA*
3. Commit changes*

4. Eva modifies README and adds a ToDo text file
5. Adds both to STAGING AREA*
6. Commit changes*

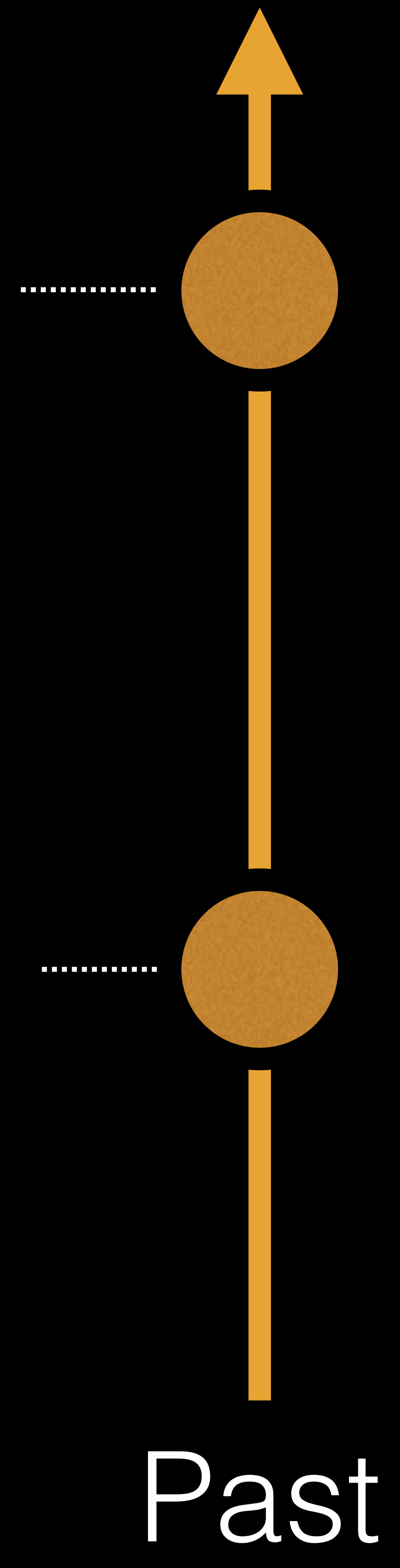
…But, how do we see the history of our project changes?

# **git log**: Timeline history of snapshots (*i.e.* commits)

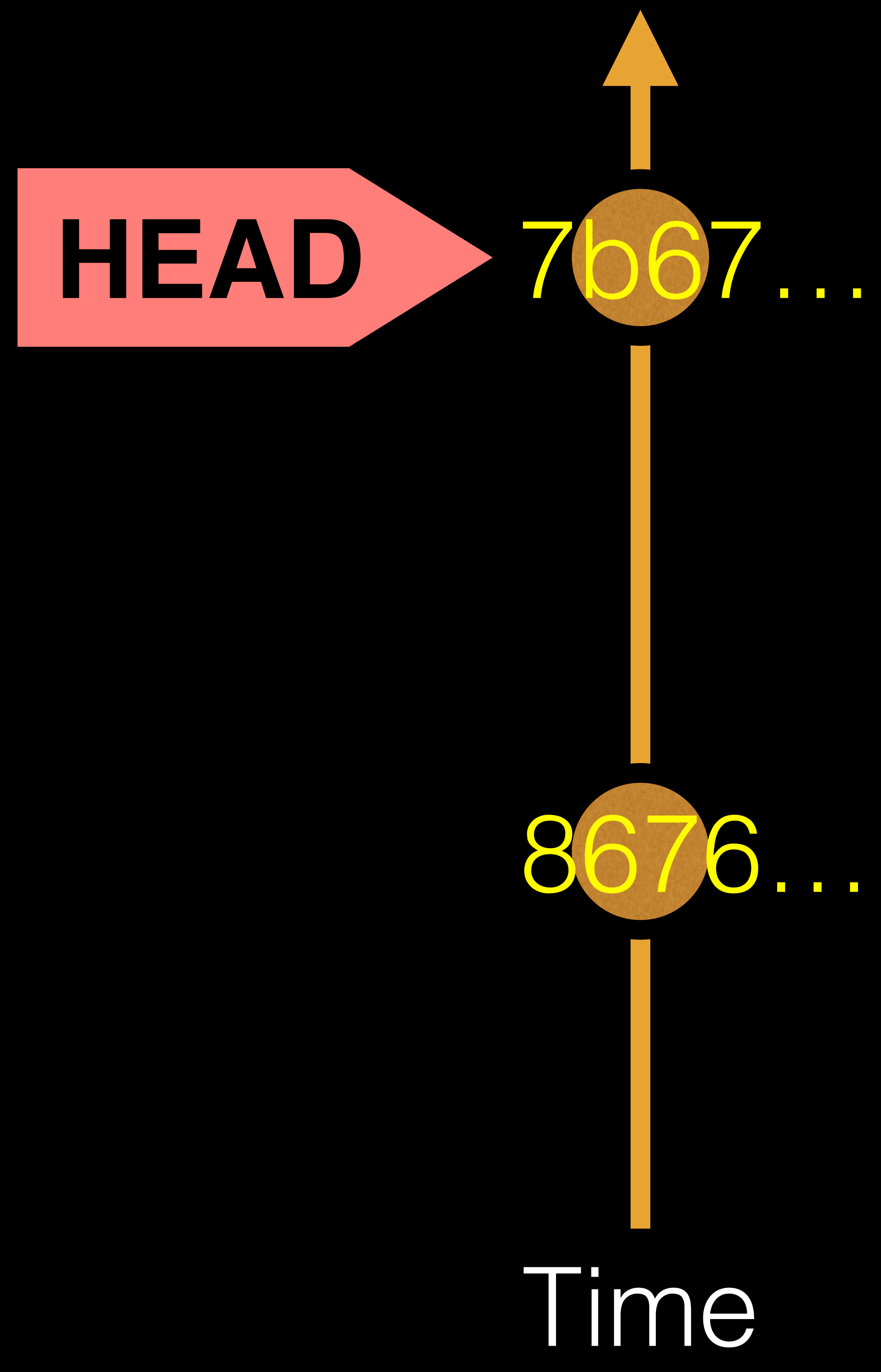
```
> git log
# commit 7b679fa747e8640918fcaad7e4c3f9c70c87b170
# Author: Barry Grant <bjgrant@umich.edu>
# Date:   Thu Jul 30 11:43:40 2015 -0400
#
#    Add ToDo and finished README
#
# commit 86768401610770ae32e2fd4faee07d1d5c68619c
# Author: Barry Grant <bjgrant@umich.edu>
# Date:   Thu Jul 30 11:26:40 2015 -0400
#
#    Create a README file
#
```

# **git log**: Timeline history of snapshots (*i.e.* commits)

```
> git log
# commit 7b679fa747e8640918fcaad7e4c3f9c70c87b170
# Author: Barry Grant <bjgrant@umich.edu>
# Date:   Thu Jul 30 11:43:40 2015 -0400
#
#    Add ToDo and finished README
#
# commit 86768401610770ae32e2fd4faee07d1d5c68619c
# Author: Barry Grant <bjgrant@umich.edu>
# Date:   Thu Jul 30 11:26:40 2015 -0400
#
#    Create a README file
#
```



# **Side-Note**: Git history is akin to a graph

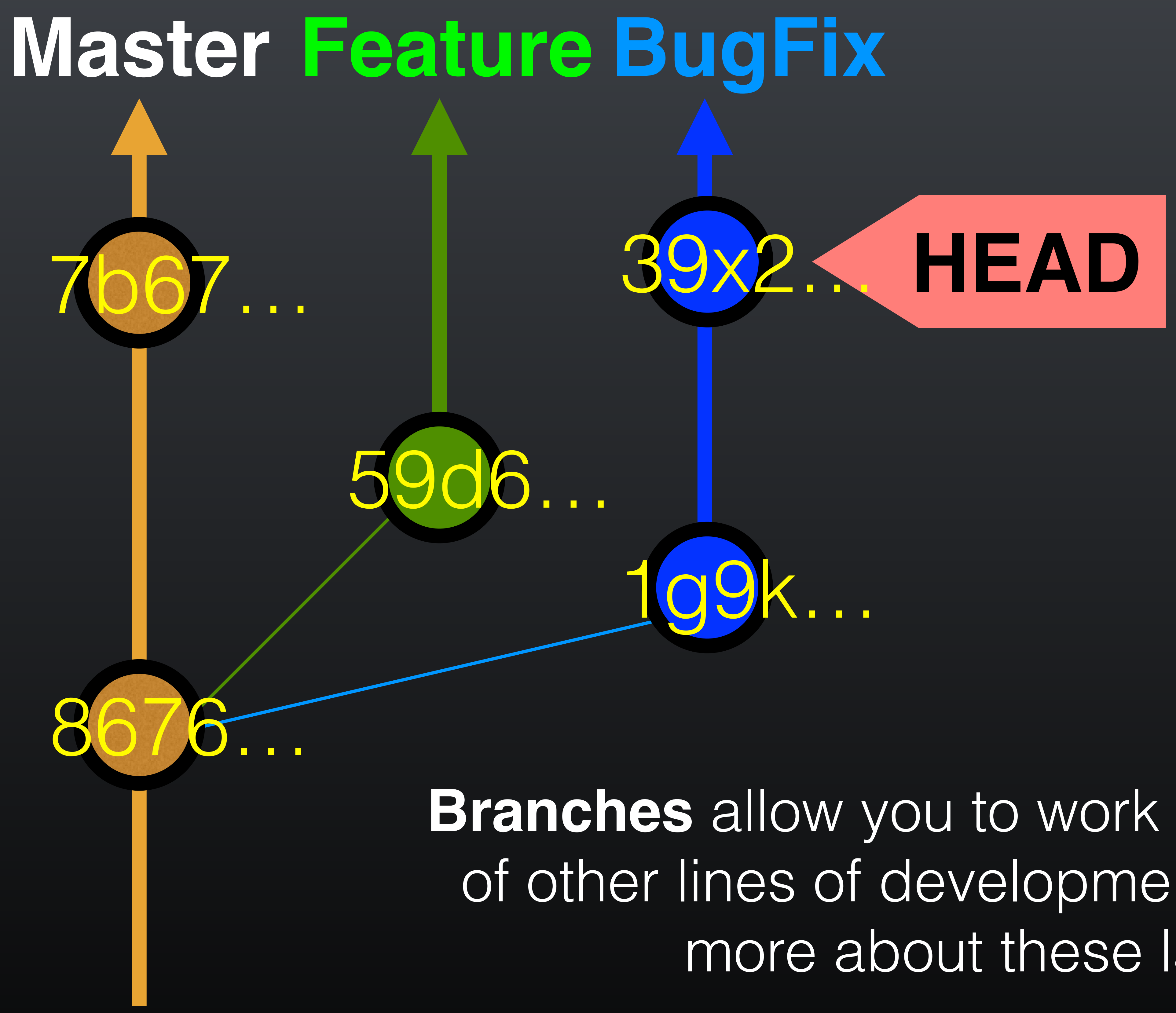


Nodes are **commits** labeled by their unique ‘**commit ID**’.

(This is a CHECKSUM of the commits author, time, commit msg, commit content and previous commit ID).

**HEAD** is a reference (or ‘**pointer**’) to the currently checked out commit (typically the most recent commit).

# Projects can have complicated graphs due to **branching**



**Branches** allow you to work independently of other lines of development we will talk more about these later!

## Key Points:

You explicitly and iteratively tell git what files to track (“**git add**”) and snapshot (“**git commit**”).

Git keeps an historical log “(**git log**”) of the content changes (and your comments on these changes) at each past commit.

It is good practice to regularly check the status of your working directory, staging arena repo (“**git status**“)

Break

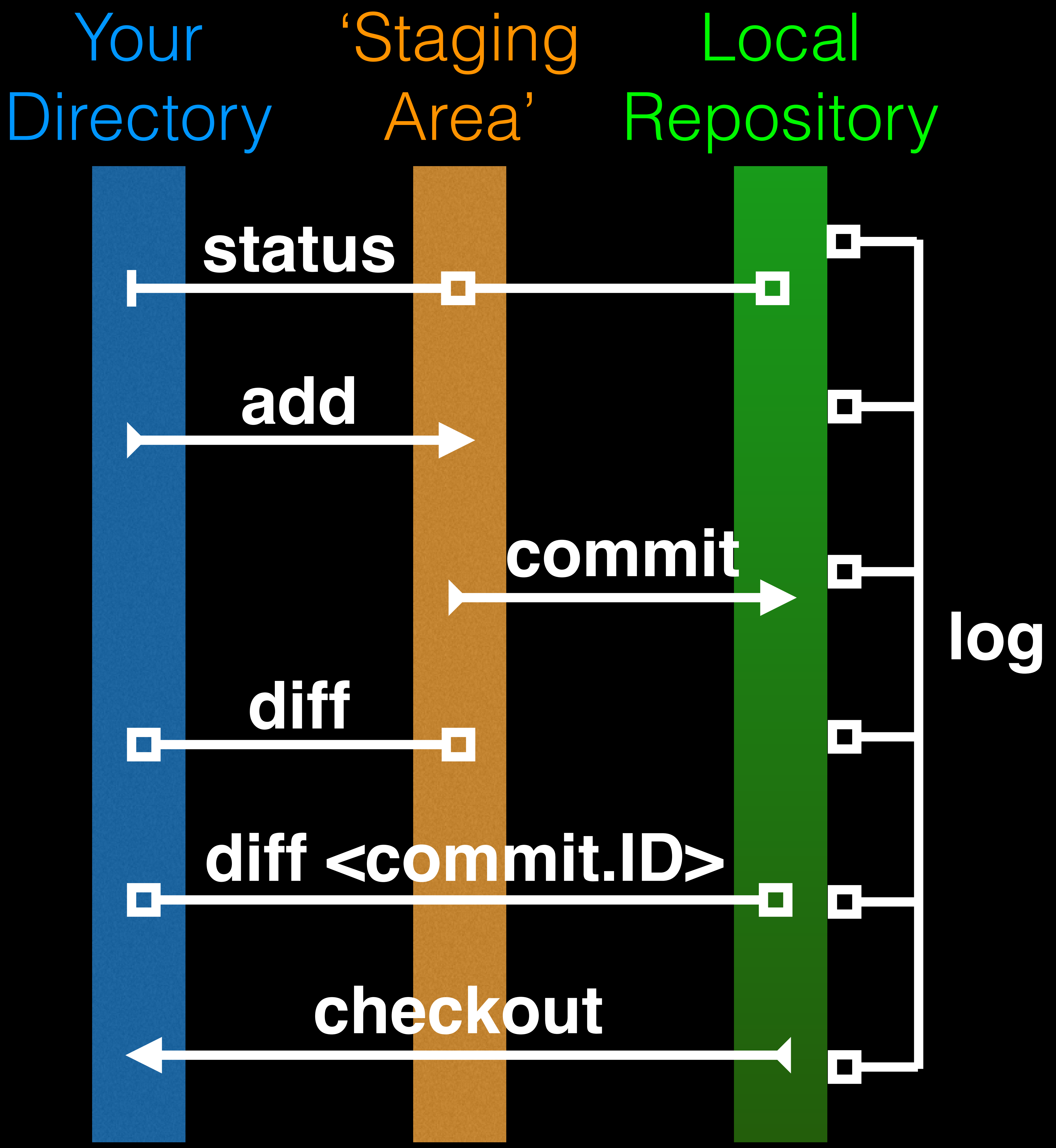
# Summary of key Git commands:

```
> git status        # Get a status report of changes since last commit
```

```
> git add <filename>                 # Tell Git which files to track/stage

> git commit -m ‘Your message’    # Take a content snapshot!
```

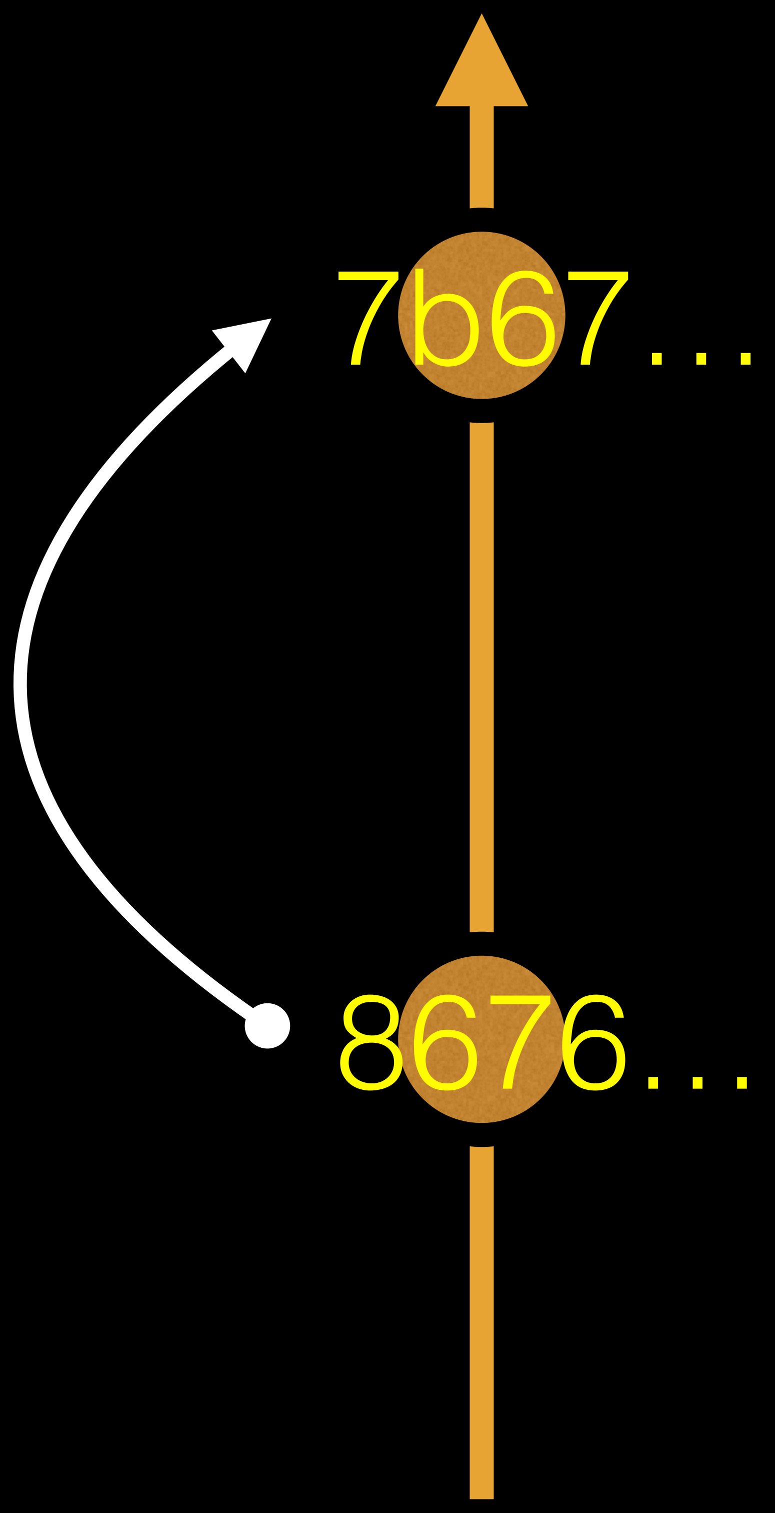
```
> git log                            # Review your commit history
```

```
> git diff <commit.ID>  <commit.ID> # Inspect content differences

> git checkout  <commit.ID>  # Navigate through the commit history
```


Your Directory
'Staging Area'
Local Repository
status
add
commit
diff
diff <commit.ID>
checkout
log

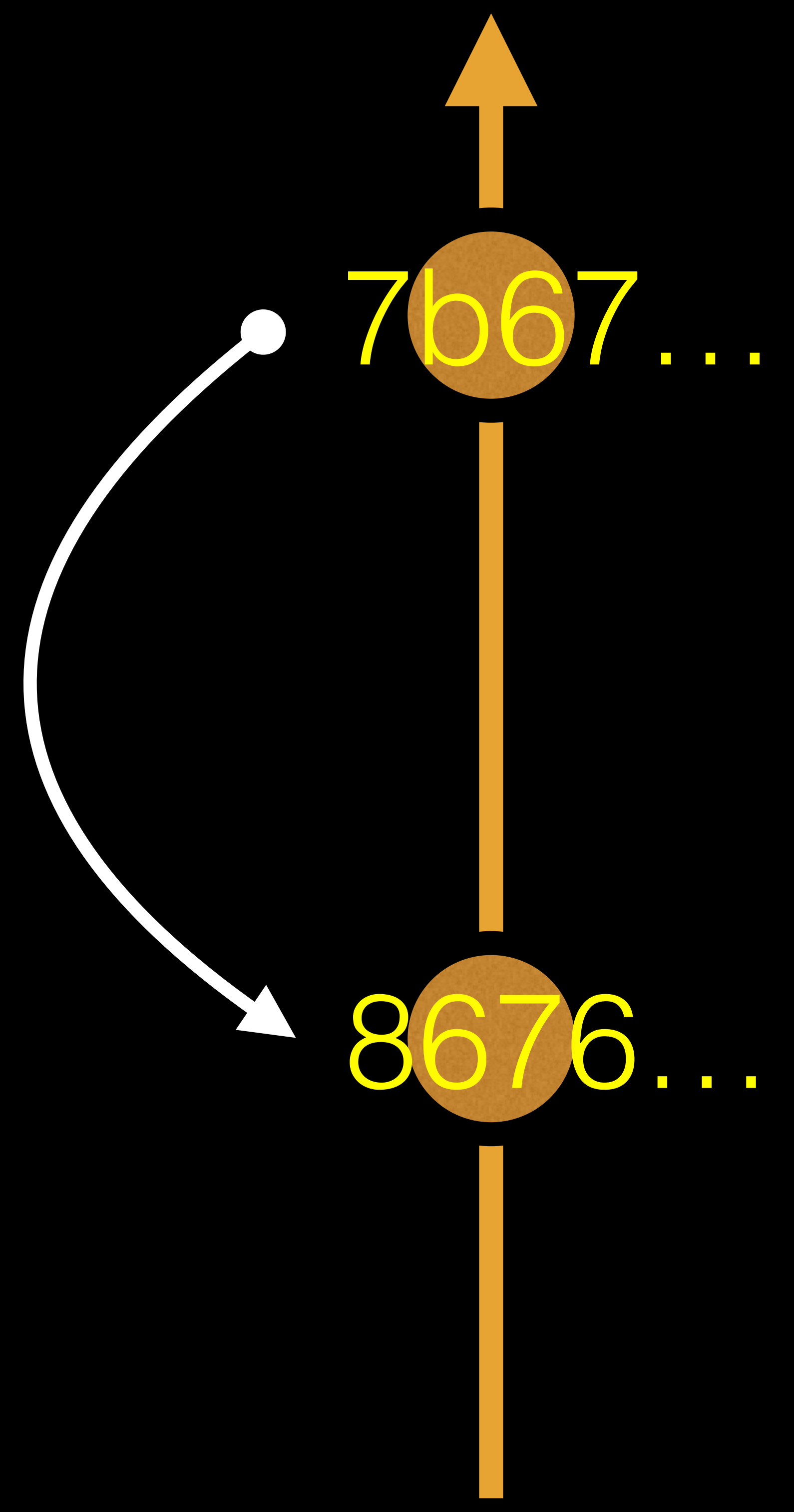
# **git diff**: Show changes between commits

```
> git diff 8676 7b67
# diff --git a/README b/README
# index 73bc85a..67bd82c 100644
# --- a/README
# +++ b/README
# @@ -1 +1,2 @@
#  This is a first line of text.
# +This is a 2nd line of text.

# diff --git a/ToDo b/ToDo
# new file mode 100644
# index 0000000..14fbd56
# --- /dev/null
# +++ b/ToDo
# @@ -0,0 +1 @@
# +Learn git basics
```



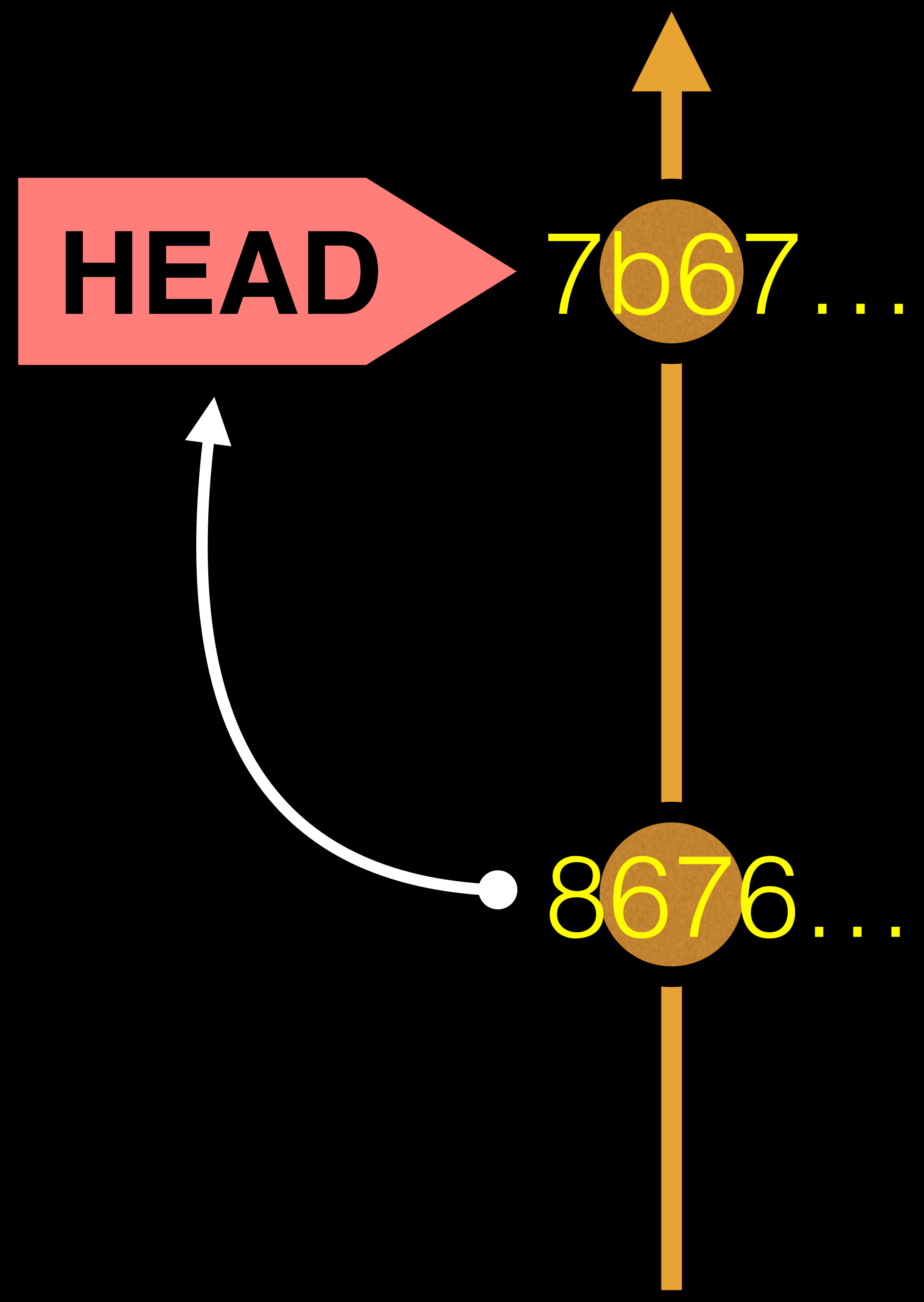
# **git diff**: Show changes between commits

```
> git diff 7b67 8676
# diff --git a/README b/README
# index 67bd82c..73bc85a 100644
# --- a/README
# +++ b/README
# @@ -1,2 +1 @@
#  This is a first line of text.
# -This is a 2nd line of text.

# diff --git a/ToDo b/ToDo
# deleted file mode 100644
# index 14fbd56..0000000
# --- a/ToDo
# +++ /dev/null
# @@ 1 +0,0 @@
# -Learn git basics
```

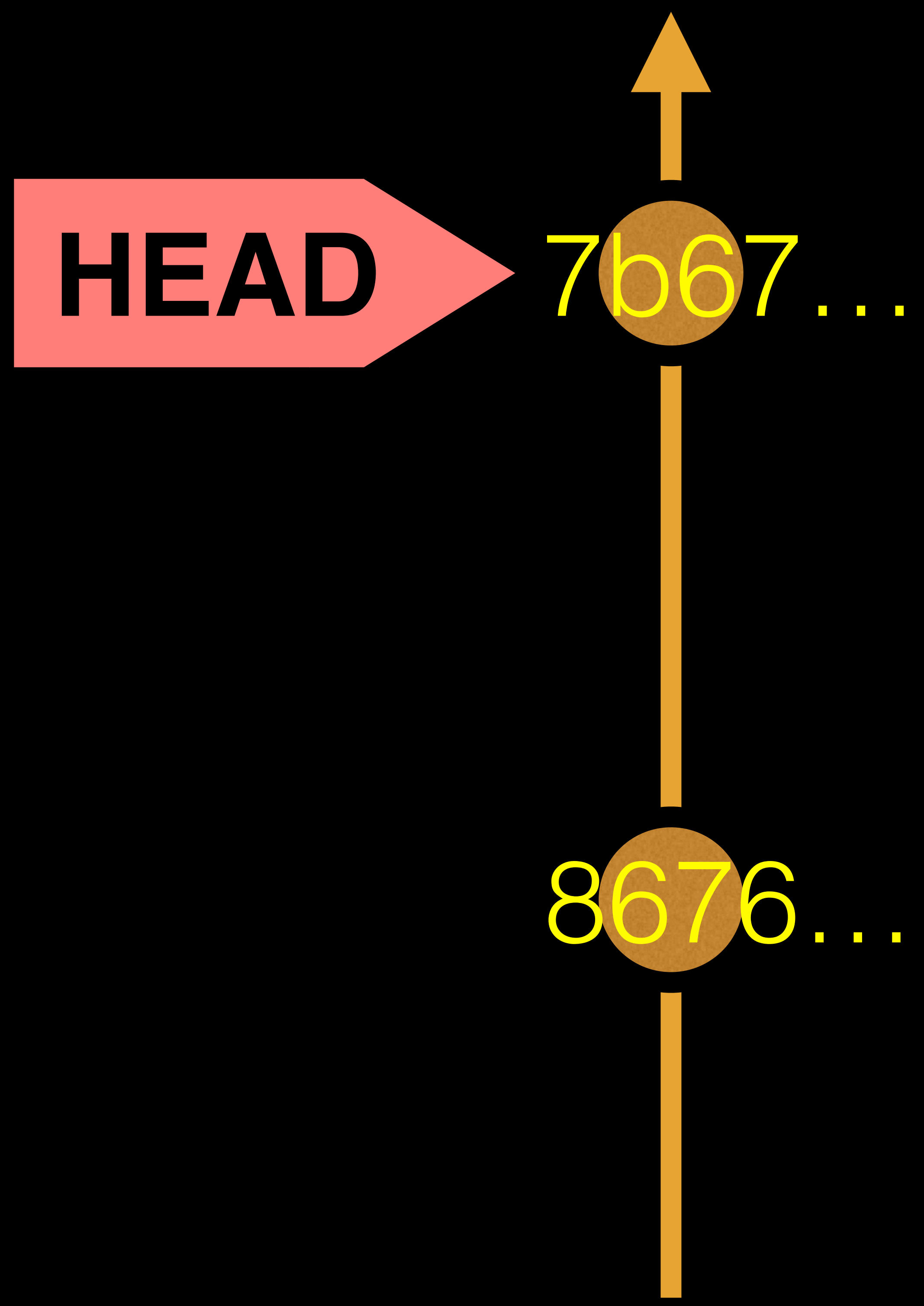


# **git diff**: Show changes between commits

```
> git diff 8676                ## Difference to current HEAD position!
# diff --git a/README b/README
# index 73bc85a..67bd82c 100644
# --- a/README
# +++ b/README
# @@ -1 +1,2 @@
#  This is a first line of text.
# +This is a 2nd line of text.

# diff --git a/ToDo b/ToDo
# new file mode 100644
# index 0000000..14fbd56
# --- /dev/null
# +++ b/ToDo
# @@ -0,0 +1 @@
# +Learn git basics
```



# **HEAD** advances automatically with each new commit

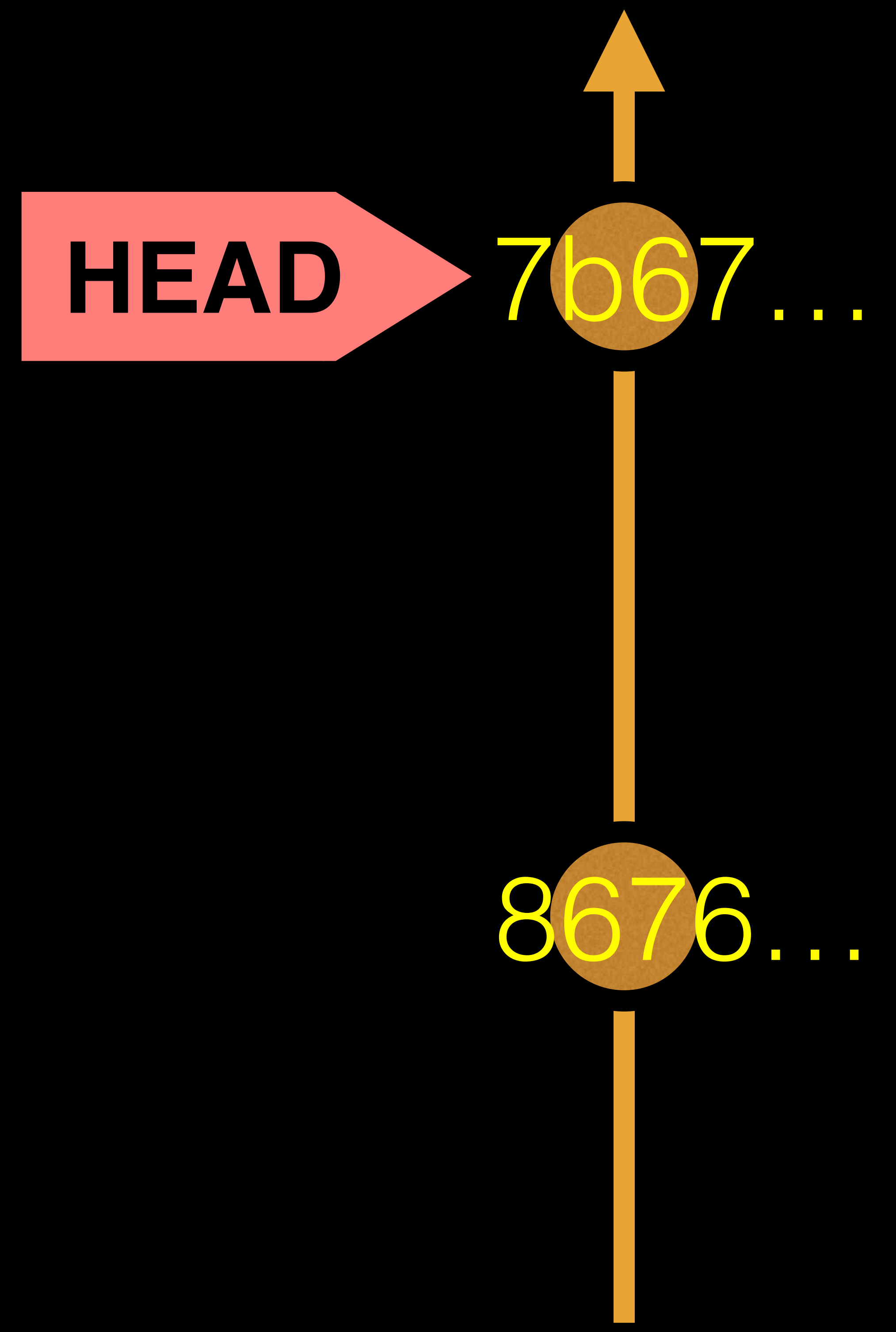


To move **HEAD** (back or forward) on the Git graph (and retrieve the associated snapshot content) we can use the command:

```
> git checkout <commit.ID>
```

# **git checkout**: Moves HEAD

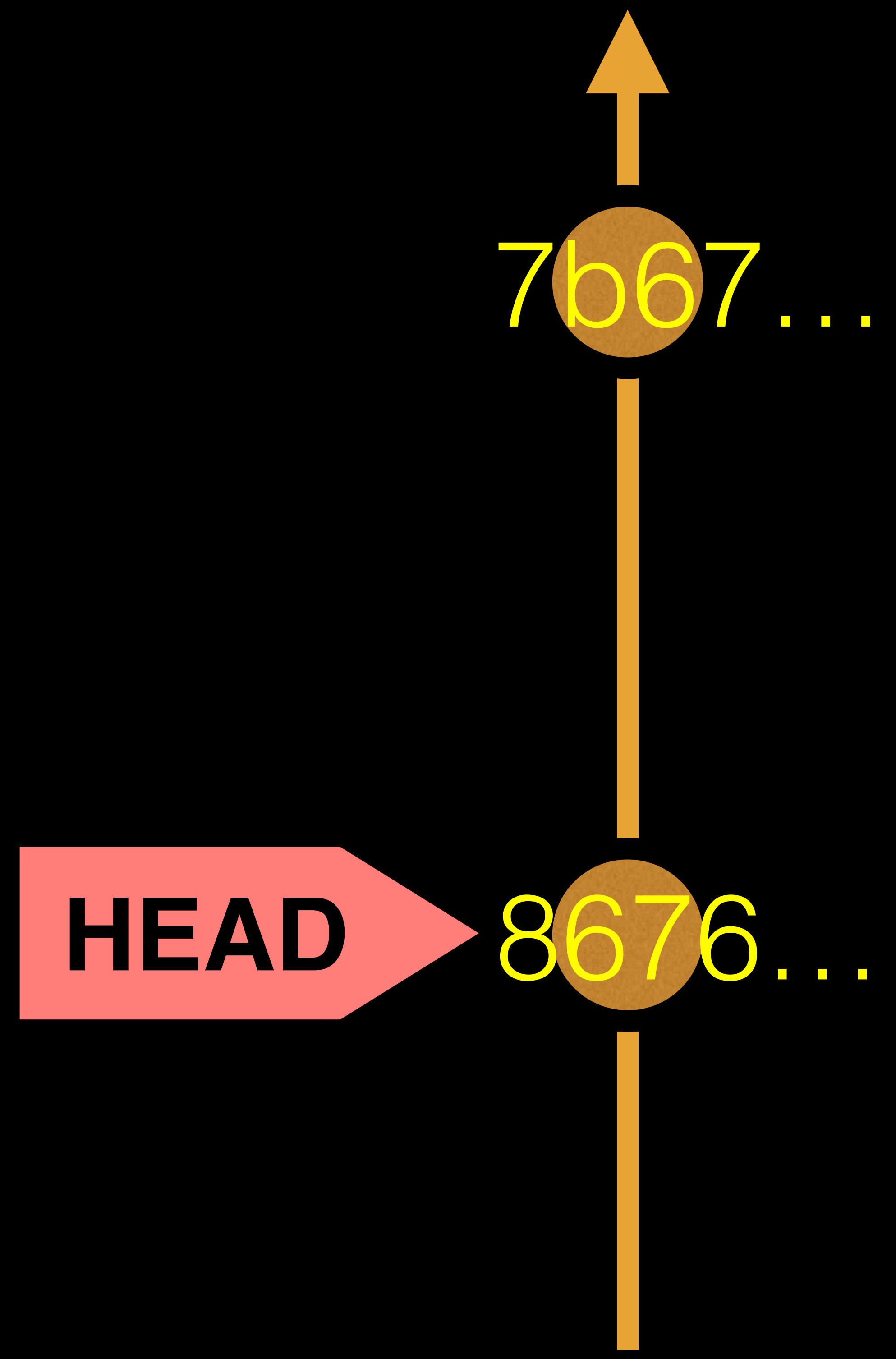
```
> more README
This is a first line of text.
This is a 2nd line of text.

> git log --oneline
# 7b679fa  Add ToDo and finished README
# 8676840  Create a README file
```



# **git checkout**: Moves HEAD (e.g. back in time)

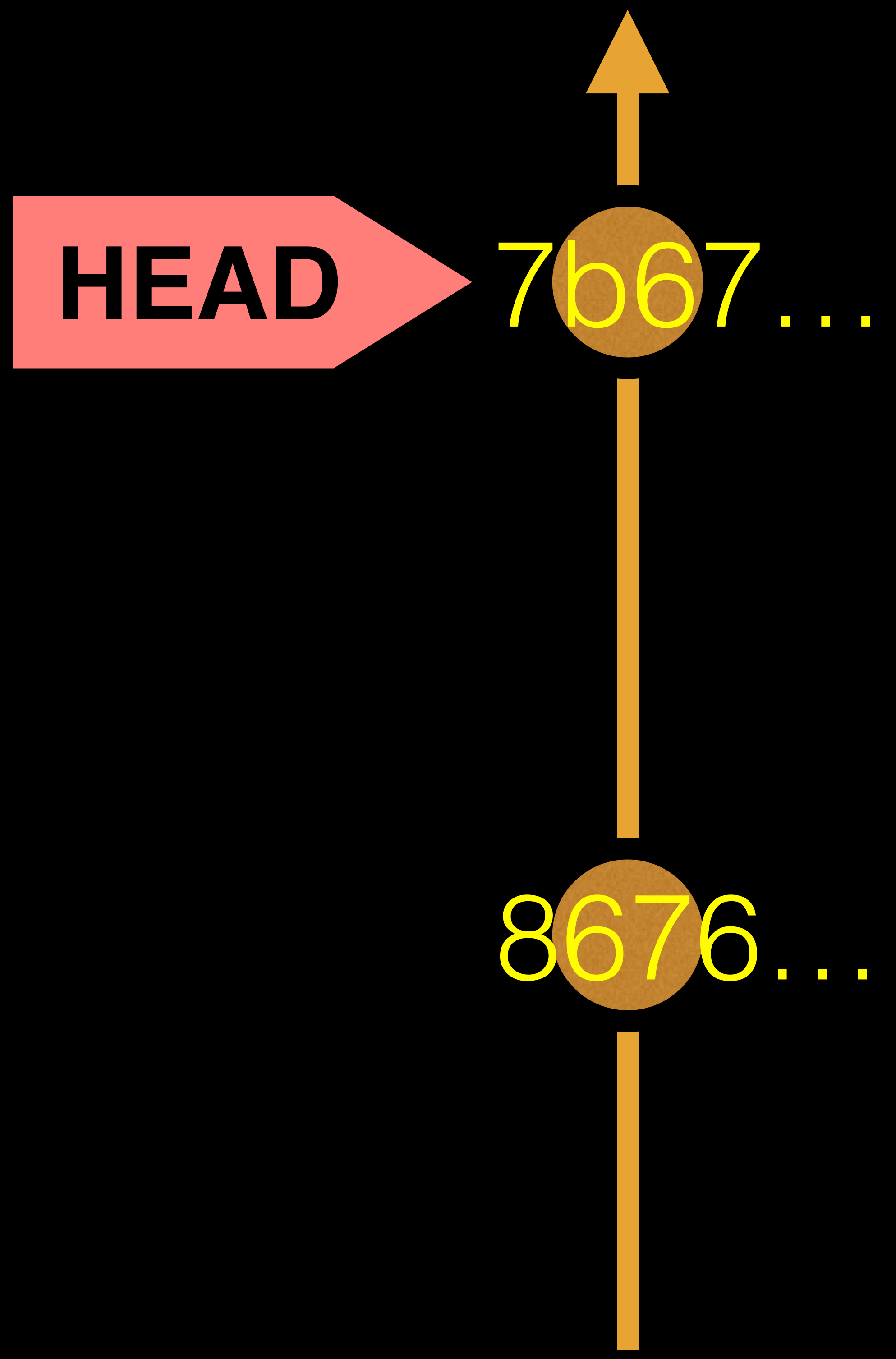
Do it Yourself!

```
> more README
This is a first line of text.
This is a 2nd line of text.

> git log --oneline
# 7b679fa  Add ToDo and finished README
# 8676840  Create a README file

> git checkout 86768
# You are in 'detached HEAD' state…<cut>…
# HEAD is now at 8676840... Create a README file

> more README
This is a first line of text.

> git log --oneline
# 8676840  Create a README file
```



# **git checkout**: Moves HEAD (e.g. back to the future!)

```
> git checkout master
# Previous HEAD position was 8676840... Create a README file
# Switched to branch 'master'

> git log --oneline
# 7b679fa Add ToDo and finished README
# 8676840 Create a README file

> more README
This is a first line of text.
This is a 2nd line of text.
```



# Side-Note: There are two* main ways to use **git checkout**

- Checking out a **commit** makes the entire working directory match that commit. This can be used to view an old state of your project.

```
> git checkout <commit.ID>
```

- Checking out a **specific file** lets you see an old version of that particular file, leaving the rest of your working directory untouched.

```
> git checkout <commit.ID> <filename>
```

# You can discard revisions with **git revert**

- The **git revert** command undoes a committed snapshot.
- But, instead of removing the commit from the project history, it figures out how to **undo the changes** introduced by the commit and **appends a new commit** with the resulting content.

```
> git revert <commit.ID>
```

- This prevents Git from losing history!

# Removing untracked files with **git clean**

- The **git clean** command removes untracked files from your working directory.

- Like an ordinary **rm** command, **git clean** is not undoable, so make sure you really want to delete the untracked files before you run it.

```
> git clean -n # dry run display of files to be ‘cleaned’

> git clean -f   # remove untracked files
```

Demo Tower

# GUIs

**Tower** (Mac only)
**GitHub_Desktop** (Mac, Windows)
**SourceTree** (Mac, Windows)
**SmartGit** (Linux)
**RStudio**

https://git-scm.com/downloads/guis