Collaboration with Git

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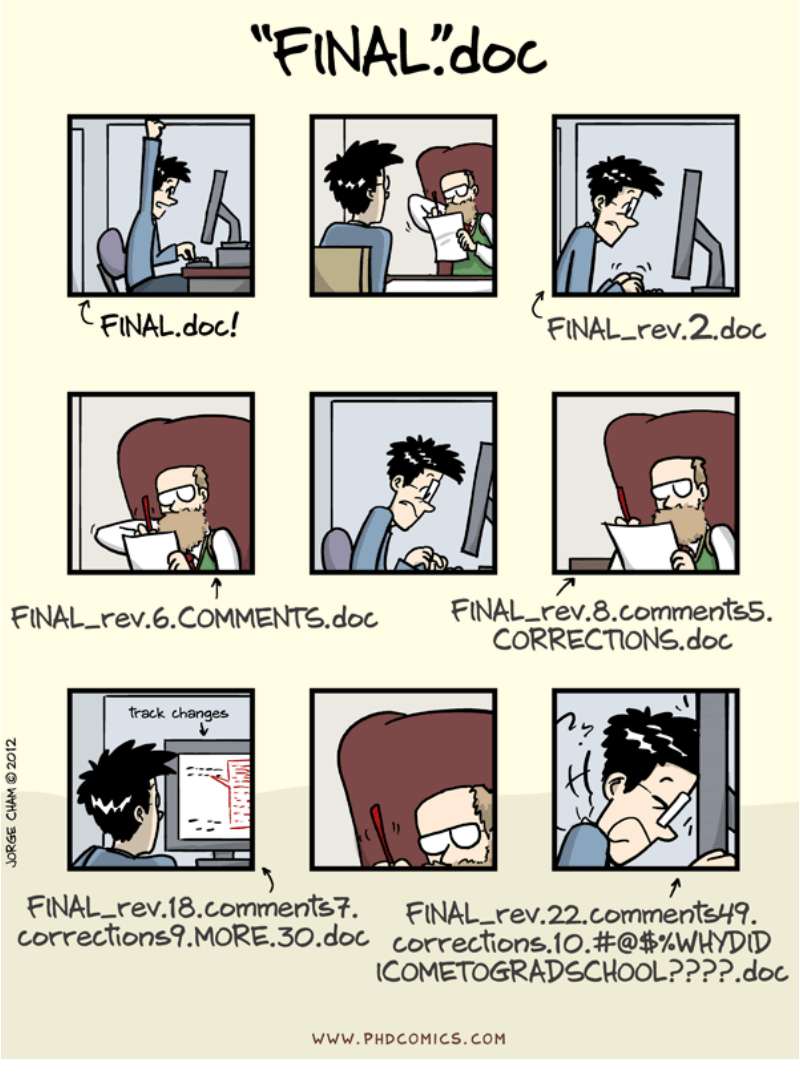
Software Carpentry

Much of this presentation will draw on the Software Carpentry lesson Version Control with Git.

That lesson goes into topics in more detail, with examples and exercises. There are regular Software Carpentry workshops at the University, open to all researchers.

Why use Version Control?



Version control systems record the details of changes made to a base version of a document or documents.

As well as allowing you to track changes over time - and to move back and forward between versions - they allow collaborators to maintain differing versions and provide mechanisms for resolving those differences.

You get to decide what changes get grouped together in a *commit*, marking a new version.

A project's commit history and metadata make up a *repository*. Repositories can be kept in sync between different computers.

Why use Git?

git

Version control systems have been around since the 1980s - you may have heard of e.g. CVS or Subversion.

Modern systems like Git and Mercurial are *distributed*, so they don't need a central server to host repositories.

Git has become the de facto standard.

Why use GitHub?

GitHub

GitHub.com has become the most popular platform for hosting Git Repositories - especially public repositories for open-source software.

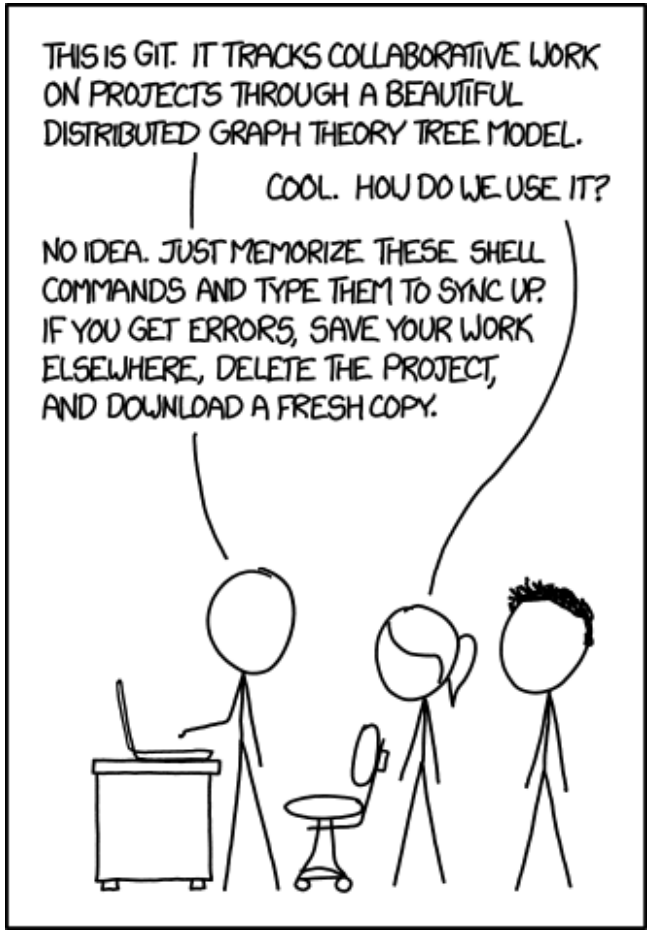
Others platforms include BitBucket and GitLab.com.

The University has an instance of GitLab (VPN) available to researchers - this is not available to users outside the University.

GitLab

GitHub also provides some additional features which are particularly useful to academic researchers.

Using Git



https://xkcd.com/1597/

There are a number of ways to work with Git on your computer:

- The command-line interface referenced in the XKCD cartoon
- Terminal based user interfaces like gitui and lazygit
- Graphical user interfaces like GitHub Desktop and SourceTree
- As a feature (or plugin) of development tools and editors like RStudio.

Other user interfaces can be considered as wrappers around the command-line interface. They tend to hide some of the details of how Git works.

This presentation includes screenshots from GitHub Desktop alongside the equivalent commands.

A Git Repository

- my-project
  - .git
  - data
  - src
  - test
  - .gitignore
  - LICENSE.txt
  - README.md
  - run.sh

- my-project
  - **.git**
  - data
  - src
  - test
  - .gitignore
  - LICENSE.txt
  - README.md
  - run.sh

.git is where Git stores the metadata about the project.

We (almost) never edit its contents directly.

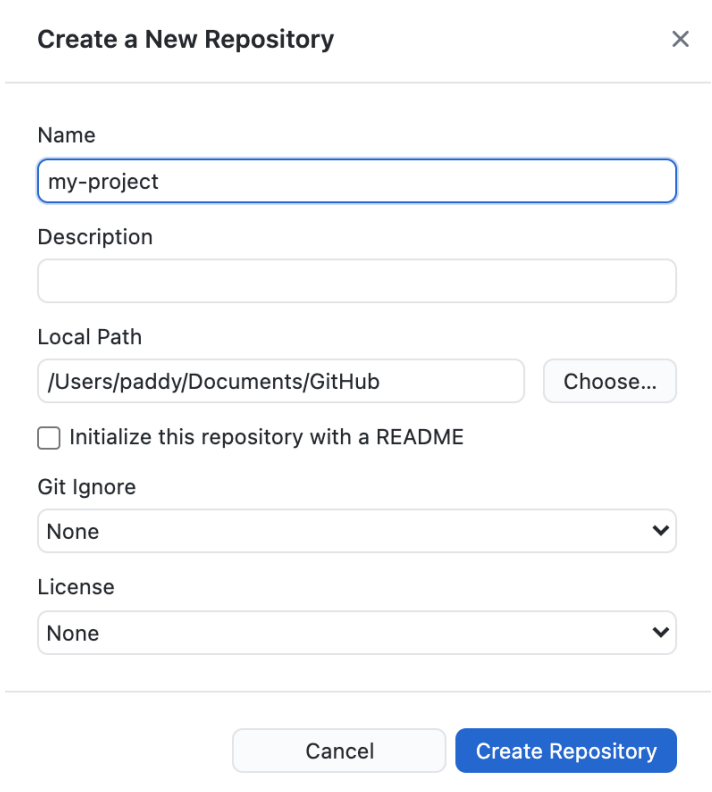
Technically, **.git** is the *Git Repository*, but you will often see **my-project** described as such.

- my-project
  - .git
  - data
  - src
  - test
  - **.gitignore**
  - LICENSE.txt
  - README.md
  - run.sh

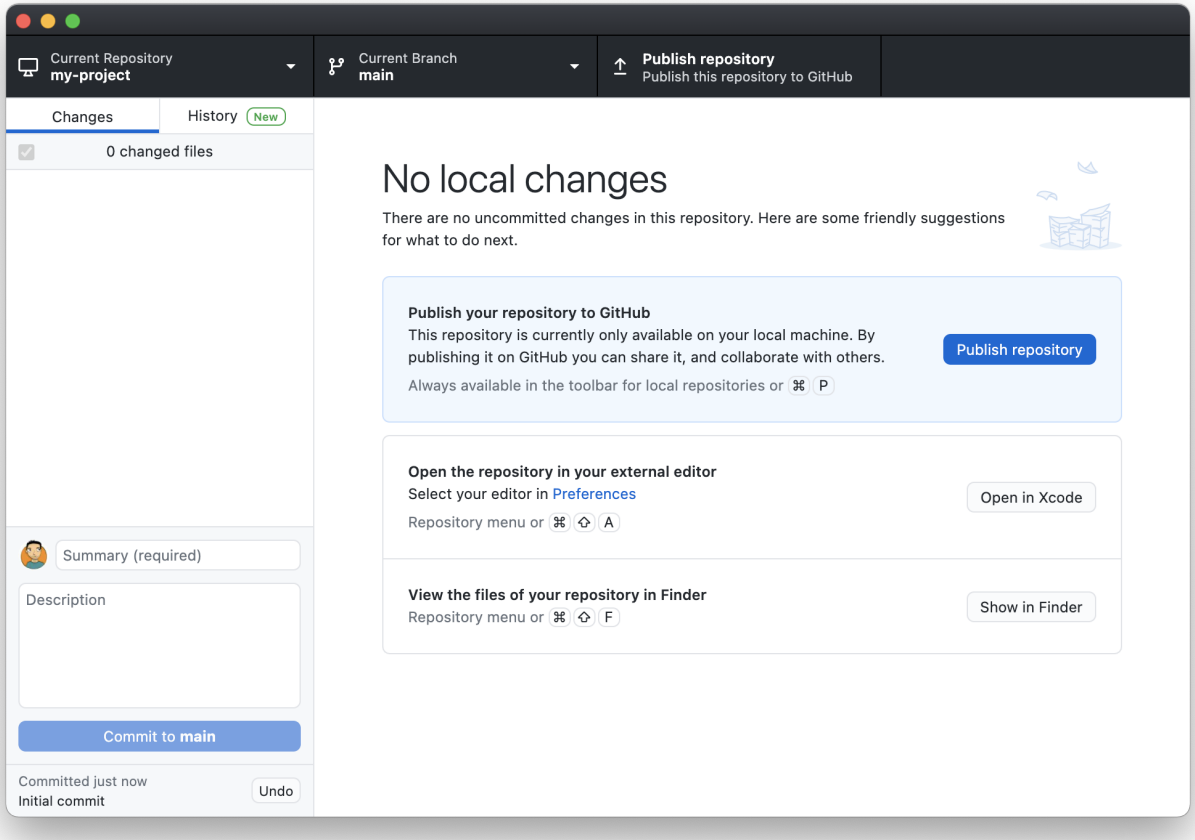
Many Git-managed projects will have a **.gitignore** file, which allows us to exclude some files from version control.

Initialising

```
$ cd /Users/paddy/Documents/GitHub
$ mkdir my-project
$ cd my-project
$ git init
```



```
$ ls -a
.        ..       .git
$ git status
On branch main
nothing to commit, working tree clean
```

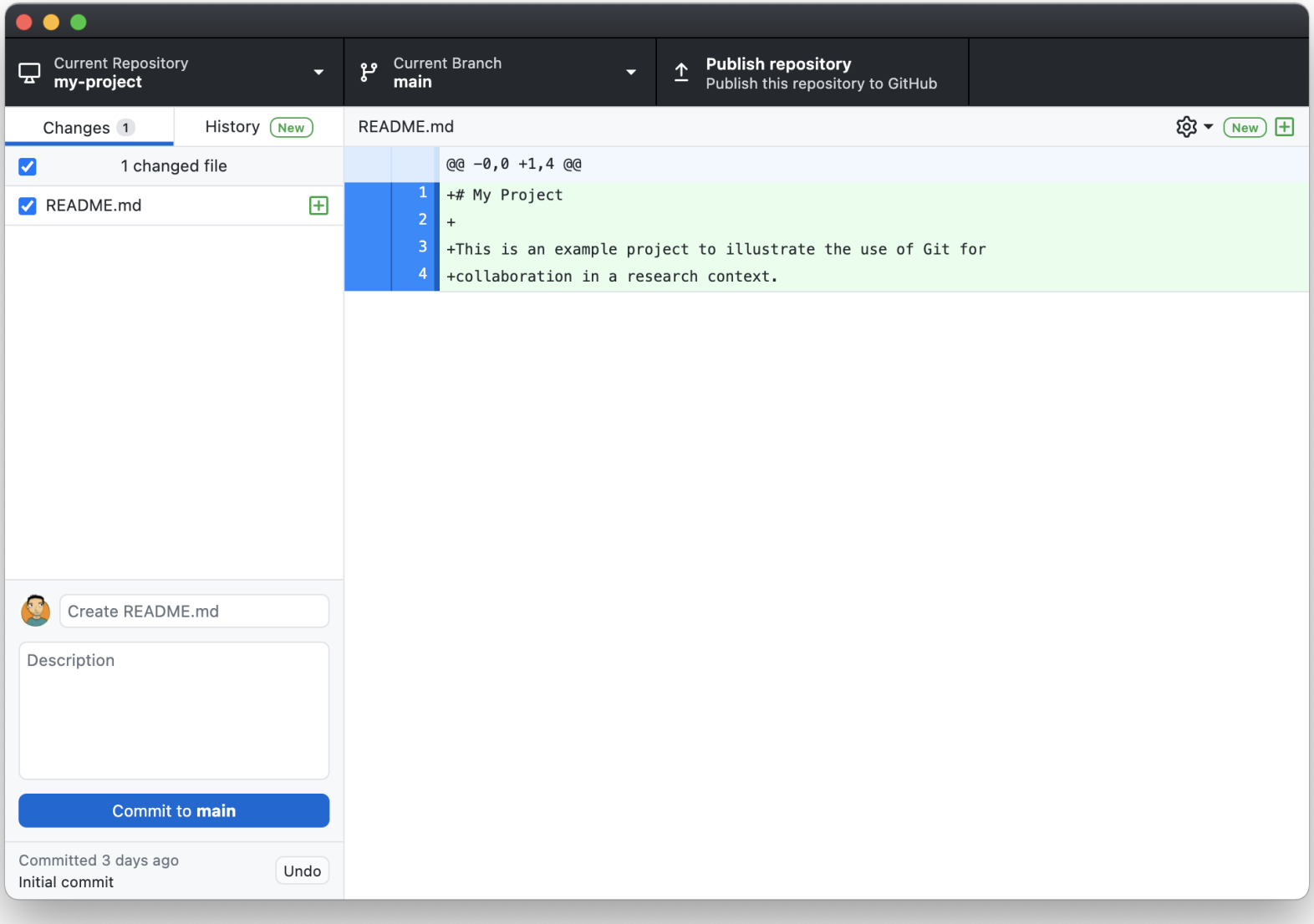


Adding and Committing

We can add a file to our project folder using any text editor or, indeed, any piece of software which allows us to save files.

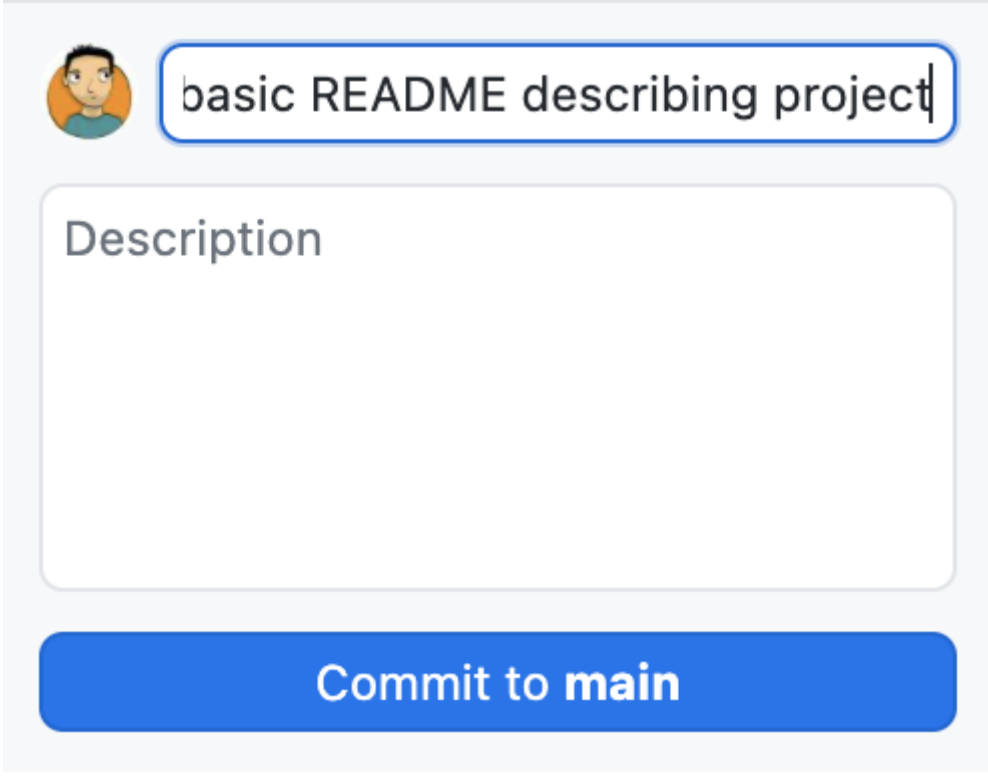
Here, we use a text editor to create a README file using markdown syntax and save it as `README.md`.

```
$ ls -a
.        ..       .git     README.md
$ cat README.md
# My Project

This is an example project to illustrate the use of Git for
collaboration in a research context.
```

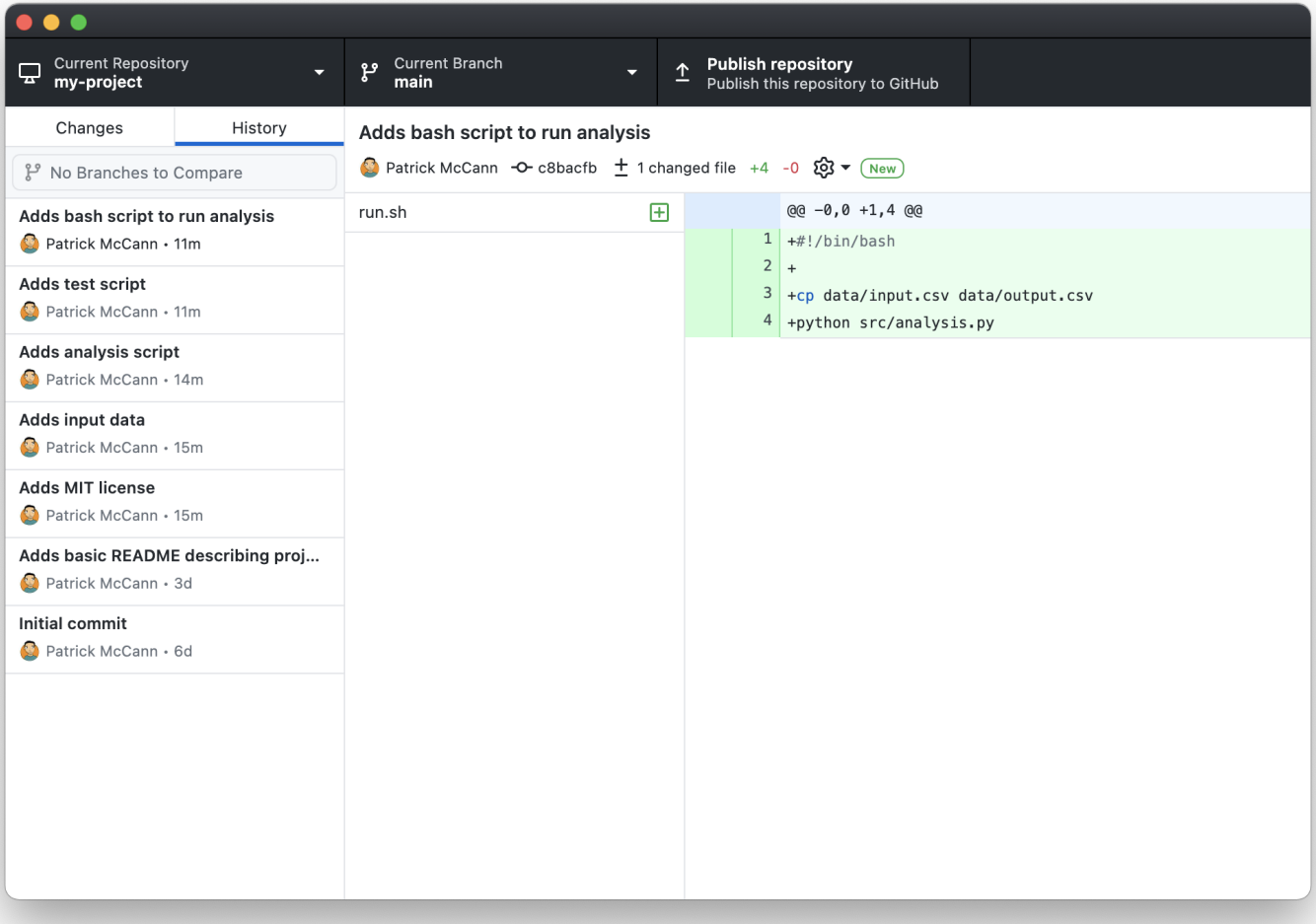

Current Repository
my-project
Current Branch
main
Publish repository
Publish this repository to GitHub
Changes 1
History New
1 changed file
README.md
Create README.md
Description
Commit to main
Committed 3 days ago
Initial commit
Undo
README.md
New
@@ -0,0 +1,4 @@
+# My Project
+
+This is an example project to illustrate the use of Git for
+collaboration in a research context.

```
$ git status
On branch main
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        README.md

nothing added to commit but untracked files present (use "git add
$ git add README.md
$ git status
On branch main
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   README.md
```

```
$ git commit -m 'Adds basic README describing project'
```



Viewing the Log



```
$ git log
commit c8bacfbdfd15e5f0924dde8461662ba8fdb676da
Author: Patrick McCann <pgm5@st-andrews.ac.uk>
Date:   Mon Nov 1 15:36:13 2021 +0000

    Adds bash script to run analysis

commit 3fa305a9d4e76e9a4bb58f724a15c2f5ae032edc
Author: Patrick McCann <pgm5@st-andrews.ac.uk>
Date:   Mon Nov 1 15:35:39 2021 +0000

    Adds test script

commit 382abfc258f398954ad897e52ff224a75188a7ca
Author: Patrick McCann <pgm5@st-andrews.ac.uk>
Date:   Mon Nov 1 15:32:32 2021 +0000
```

```
$ git diff HEAD~1 HEAD
diff --git a/run.sh b/run.sh
new file mode 100755
index 0000000..a84485c
 --- /dev/null
 +++ b/run.sh
@@ -0,0 +1,4 @@
+#!/bin/bash
+
+cp data/input.csv data/output.csv
+python src/analysis.py
```

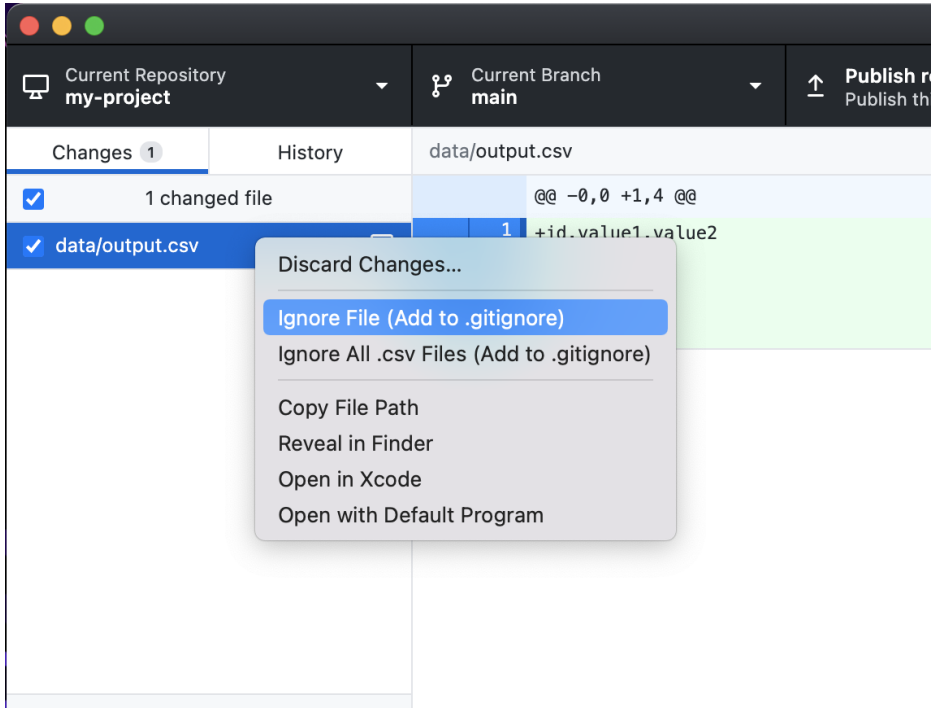
AS A PROJECT DRAGS ON, MY GIT COMMIT MESSAGES GET LESS AND LESS INFORMATIVE.

https://xkcd.com/1296/

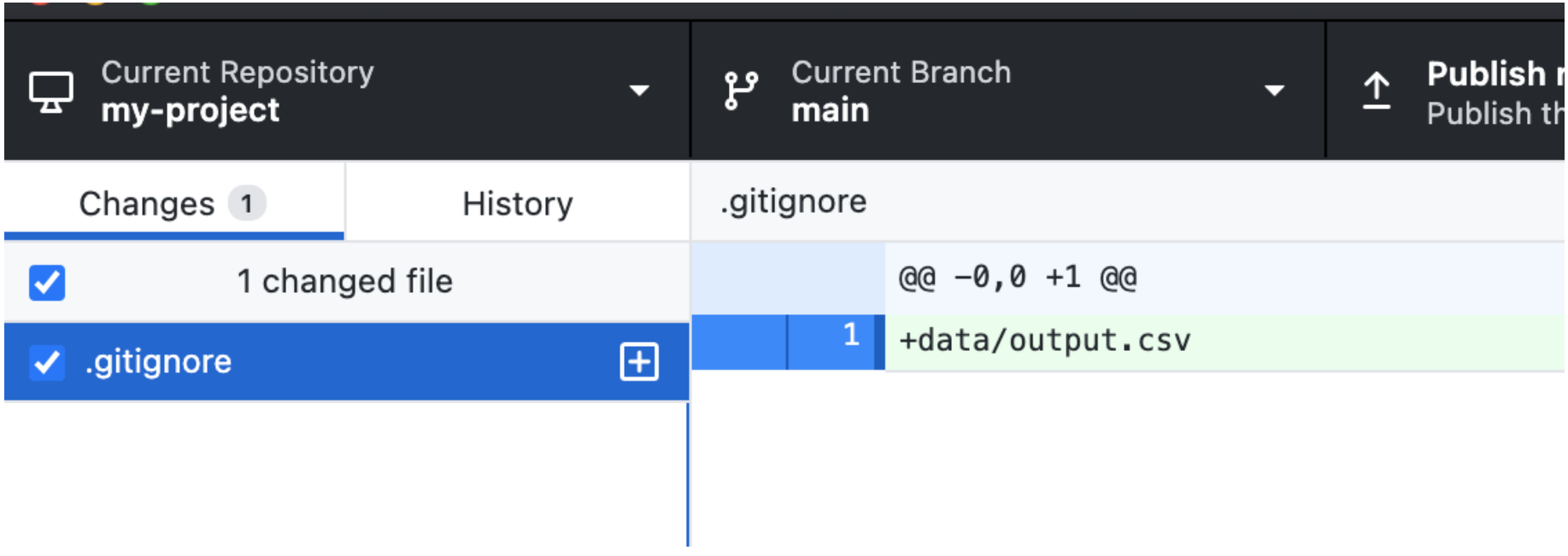
Ignoring Things

There are situations where we have a file or files in our repository which we don't want to place under version control e.g.

- The results of analysis.
- Anything containing a password or other sensitive data.
- Files created by your tools which aren't really part of the project.




```
$ git status
On branch main
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        data/output.csv

nothing added to commit but untracked files present (use "git add
$ git ignore data/output.csv
Adding pattern(s) to: .gitignore
... adding 'data/output.csv'
```




```
$ git status
On branch main
Untracked files:
  (use "git add <file>..." to include in what will be committed)
    .gitignore

nothing added to commit but untracked files present (use "git add
```

Remotes

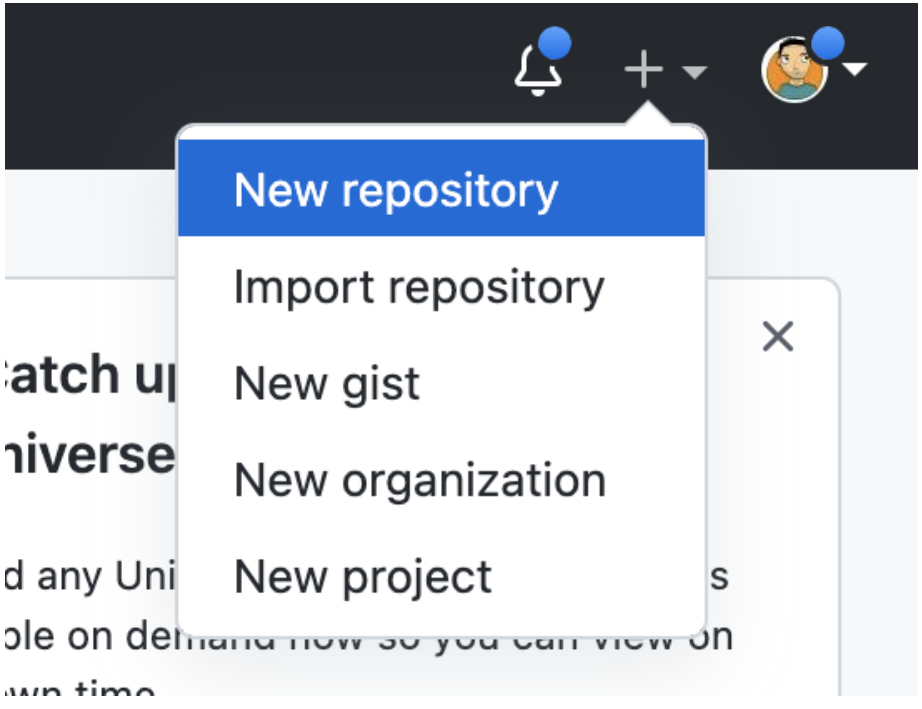
So far, everything has been on our own computer. This is useful, but Git really comes into its own when collaborating with others.

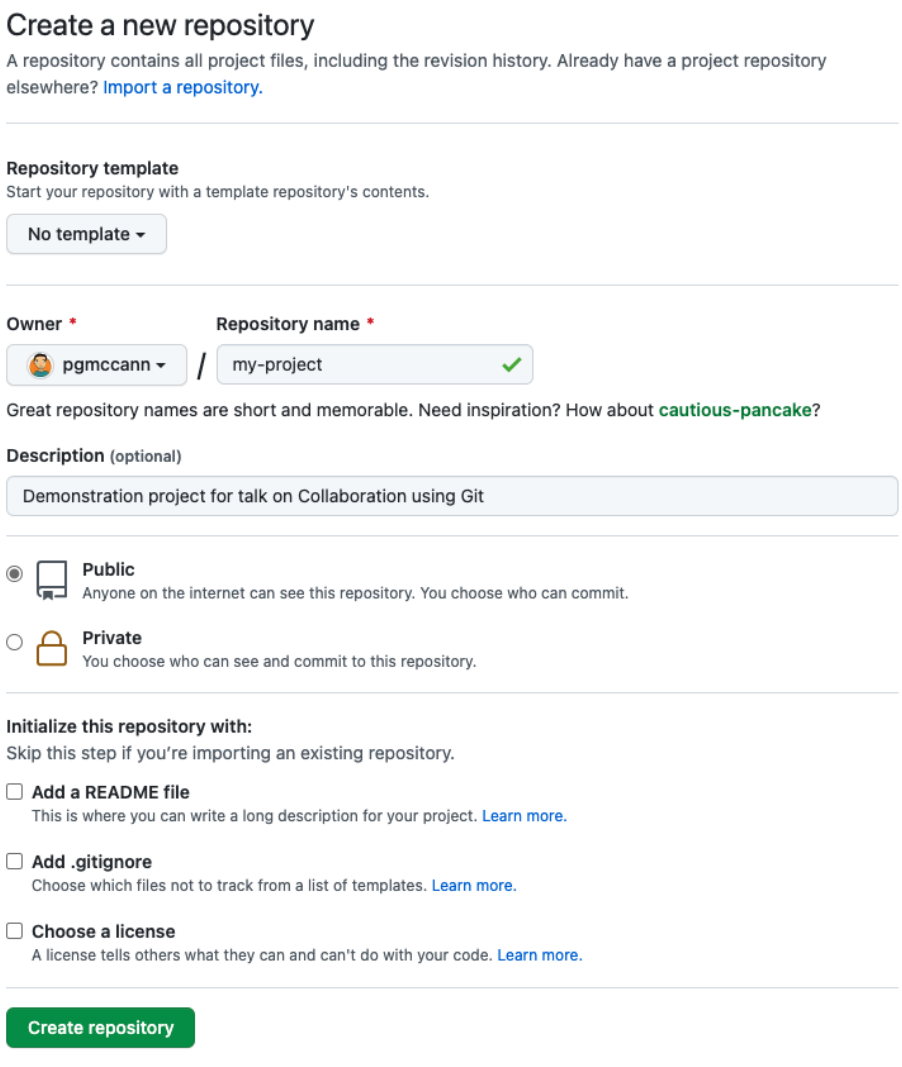
To do that, we need to keep our projects in sync between multiple computers (also useful if you work from multiple computers yourself).

You can, in principle, have your Git on your computer communicate directly with your colleagues' to keep things in sync, but it's generally easier to sync with another location to which you all have access.

That other location could be a desktop computer in your office or it could be GitHub (or GitLab) - as far as Git is concerned there isn't really a difference.

Creating a repo on GitHub.com





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

Set up in Desktop or HTTPS SSH `git@github.com:pgmccann/my-project.git`

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

...or create a new repository on the command line

```
echo "# my-project" >> README.md
git init
git add README.md
git commit -m "first commit"
git branch -M main
git remote add origin git@github.com:pgmccann/my-project.git
git push -u origin main
```

...or push an existing repository from the command line

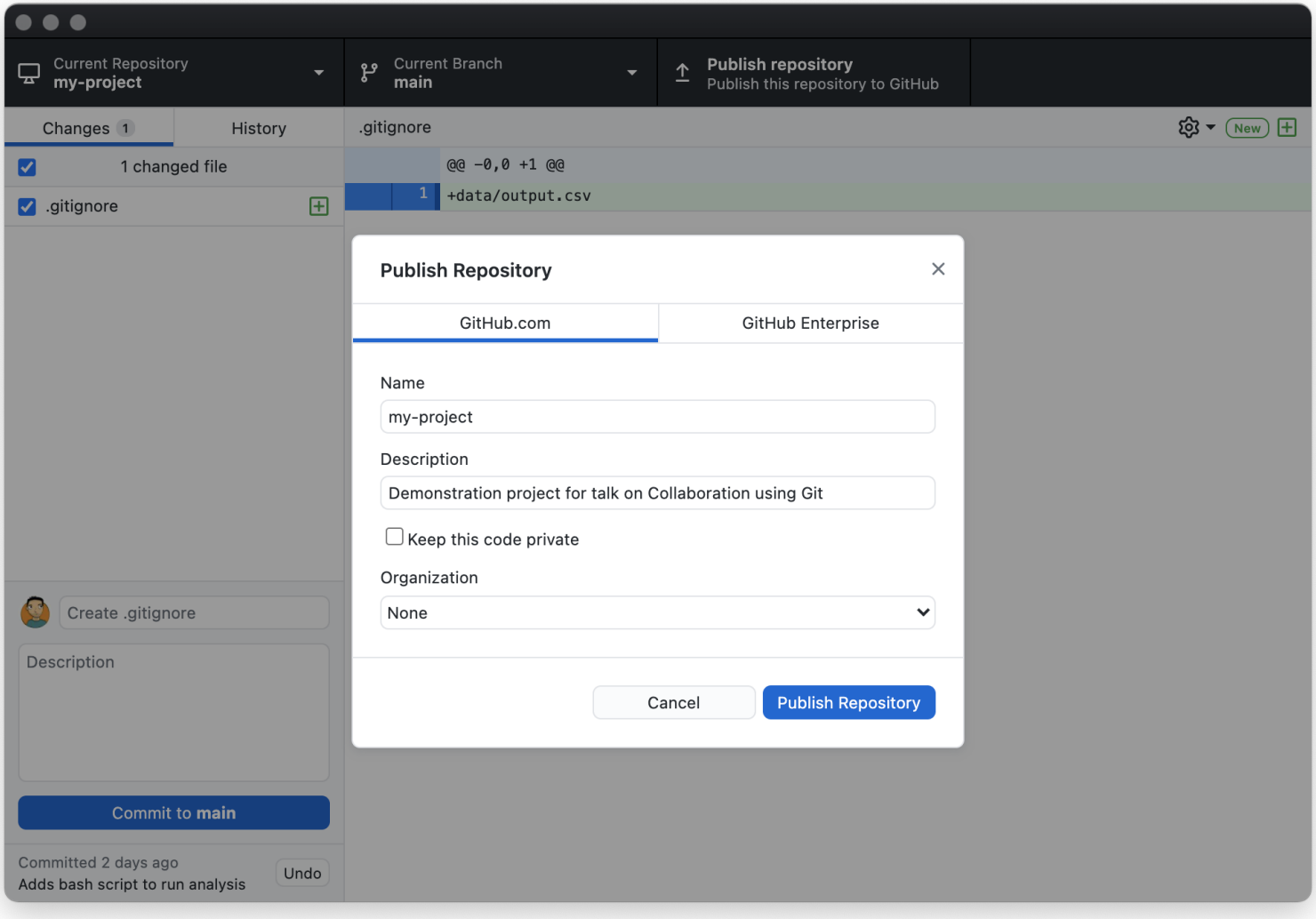
```
git remote add origin git@github.com:pgmccann/my-project.git
git branch -M main
git push -u origin main
```

...or import code from another repository

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

Import code

Publishing a repo from GitHub Desktop



The repo on GitHub

Search or jump to... / Pulls Issues Marketplace Explore

pgmccann / my-project Public

Unwatch 1 Star 0 Fork 0

Code Issues Pull requests Actions Projects Wiki Security Insights ...

main Go to file Add file Code

pgmccann Adds bash script to run analysis ... 2 days ago 7

data	Adds input data	2 days ago
src	Adds analysis script	2 days ago
test	Adds test script	2 days ago
.gitattributes	Initial commit	8 days ago
LICENSE.txt	Adds MIT license	2 days ago
README.md	Adds basic README describing project	5 days ago
run.sh	Adds bash script to run analysis	2 days ago

README.md

My Project

This is an example project to illustrate the use of Git for collaboration in a research context.

About

Demonstration project for talk on Collaboration using Git

Readme

MIT License

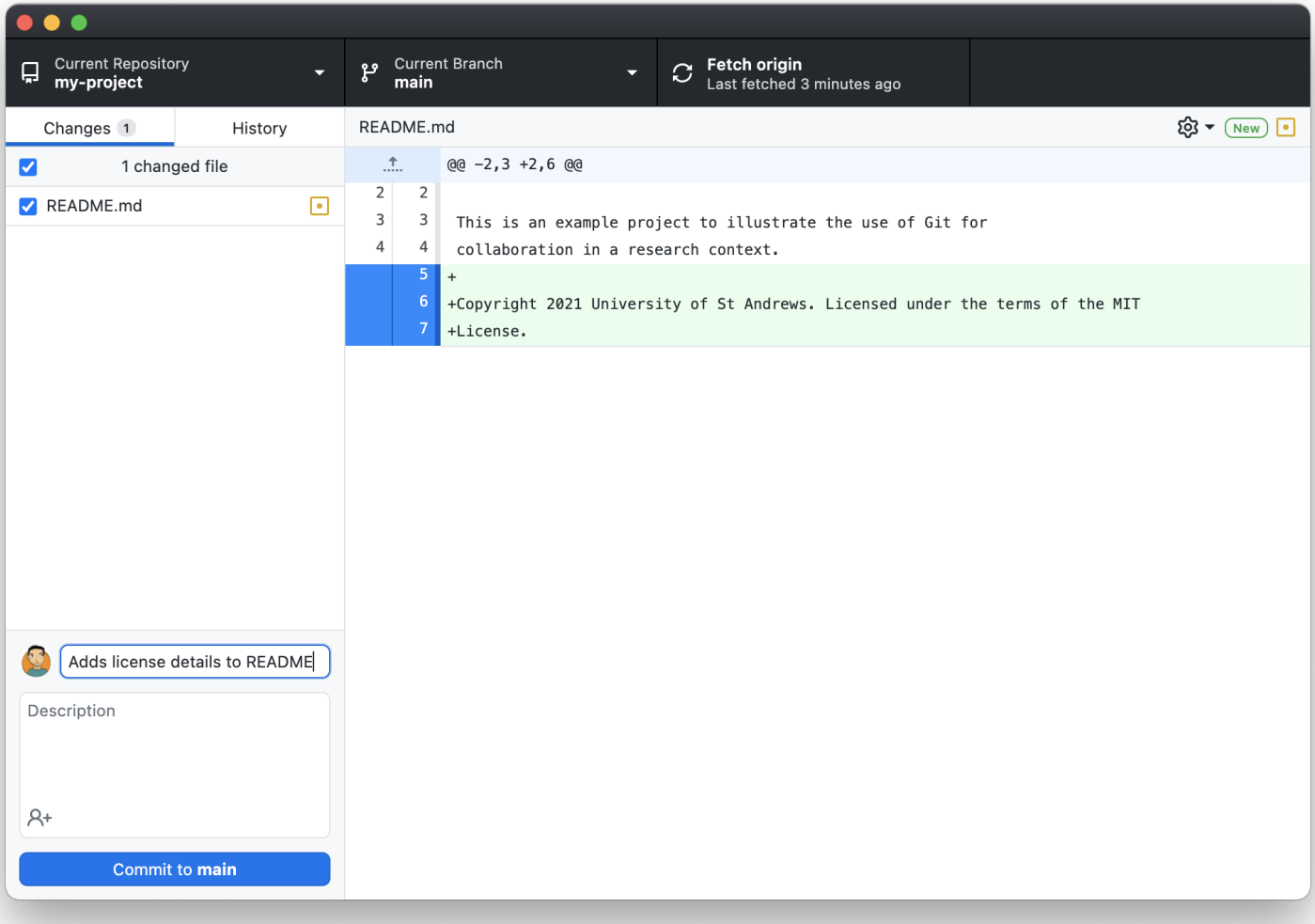
Releases

No releases published
Create a new release

Packages

No packages published
Publish your first package

Pushing


Current Repository
my-project
Current Branch
main
Fetch origin
Last fetched 3 minutes ago
Changes 1
History
1 changed file
README.md
README.md
New
@@ -2,3 +2,6 @@
This is an example project to illustrate the use of Git for
collaboration in a research context.
+
+Copyright 2021 University of St Andrews. Licensed under the terms of the MIT
+License.
Adds license details to README
Description
Commit to main

```
$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working dire
    modified:   README.md

no changes added to commit (use "git add" and/or "git commit -a")
$ git diff
diff --git a/README.md b/README.md
index e0a3173..b9fd878 100644
 --- a/README.md
 +++ b/README.md
@@ -2,3 +2,6 @@
```

After committing...

```
$ git status
On branch main
Your branch is ahead of 'origin/main' by 1 commit.
  (use "git push" to publish your local commits)

nothing to commit, working tree clean
$ git push
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 4 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 429 bytes | 429.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 local obje
To https://github.com/pgmccann/my-project.git
   2bf80ab..3ec775a  main -> main
```

README.md	Adds license details to README	34 minutes ago
run.sh	Adds bash script to run analysis	2 days ago

README.md

My Project

This is an example project to illustrate the use of Git for collaboration in a research context.

Pulling

Let's add a License badge using GitHub's editing interface.

License MIT

my-project / README.md in main

Cancel changes

Edit file | Preview

Spaces 2 Soft wrap

```
# My Project

This is an example project to illustrate the use of Git for
collaboration in a research context.

Copyright 2021 University of St Andrews. Licensed under the terms of the MIT
License.

```

my-project / README.md in main

Cancel changes

Edit file | Preview | Spaces | 2 | Soft wrap

```
[![License: MIT](https://img.shields.io/badge/License-MIT-yellow.svg)](https://opensource.org/licenses/MIT)

# My Project

This is an example project to illustrate the use of Git for
collaboration in a research context.

Copyright 2021 University of St Andrews. Licensed under the terms of the MIT
License.

```

Commit changes

Adds License badge to README

Add an optional extended description...

pgm5@st-andrews.ac.uk

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.

Commit changes | Cancel

README.md	Adds License badge to README	now
run.sh	Adds bash script to run analysis	2 days ago

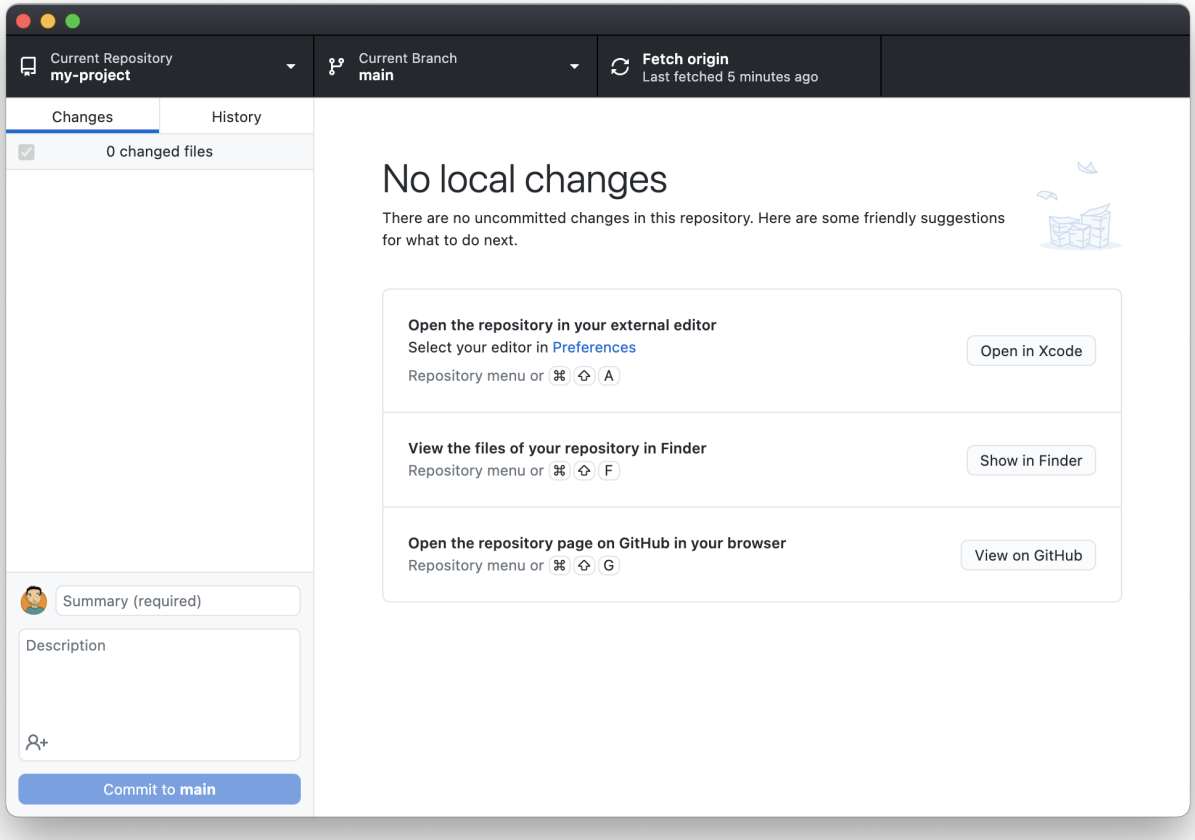
README.md

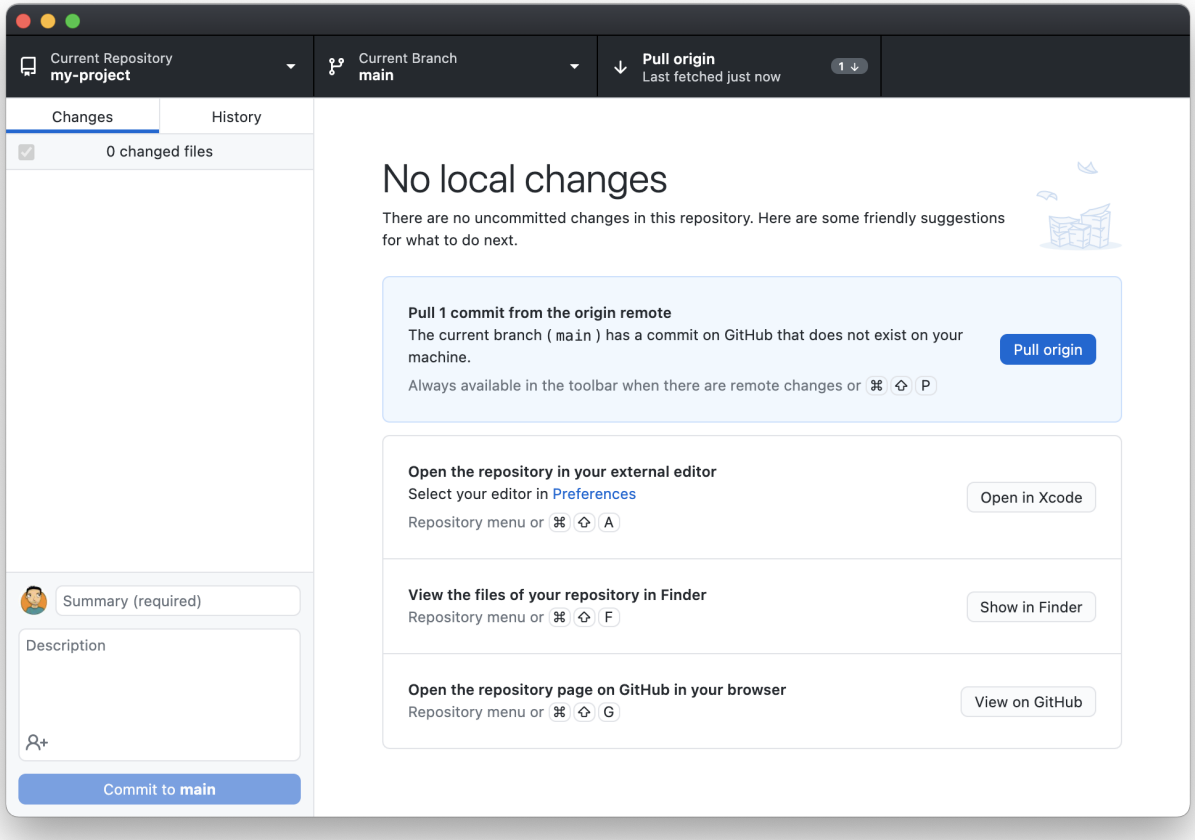
License MIT

My Project

This is an example project to illustrate the use of Git for collaboration in a research context.

```
$ git status
On branch main
Your branch is up to date with 'origin/main'.

nothing to commit, working tree clean
```






```
$ git pull
Updating 3ec775a..658258a
Fast-forward
 README.md | 2 ++
 1 file changed, 2 insertions(+)
```

Current Repository
my-project

Current Branch
main

Fetch origin
Last fetched 8 minutes ago

Changes | History

No Branches to Compare

Adds License badge to README
Paddy McCann • 17m

Adds license details to README
Patrick McCann • 1h

Ignores the output data
Patrick McCann • 1h

Adds bash script to run analysis
Patrick McCann • 1d

Adds test script
Patrick McCann • 1d

Adds analysis script
Patrick McCann • 1d

Adds input data
Patrick McCann • 1d

Adds MIT license
Patrick McCann • 1d

Adds basic README describing proj...
Patrick McCann • 4d

Initial commit
Patrick McCann • Oct 26, 2021

Adds License badge to README

Paddy McCann 658258a 1 changed file +2 -0 New

README.md

```
@@ -1,3 +1,5 @@
+[![License: MIT](https://img.shields.io/badge/License-MIT-yellow.svg)](https://opensource.org/licenses/MIT)
+
 # My Project

 This is an example project to illustrate the use of Git for
```

Git in RStudio

Collaboration

Branching

Forking

Automation

Open Science

Licensing

Citation

Zenodo and Pure