

# Using Git for Science

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Find this at: <https://github.com/ABRG-Models/GitTutorial>

# Introduction

- ▶ This session is about a command-line tool called Git.
- ▶ Git is a tool for managing text, so these slides are naturally text heavy!
- ▶ We'll use it with the help of a website built around Git:  
[github.com](https://github.com)
- ▶ I'll give an overview of Git, including its jargon  
(**clone, commit, checkout...**) and why it's such a useful tool, then we'll go through some example tasks together.

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1. Revision control allows you to have different versions of a single file without having to explicitly make copies
2. Most revision control tools allow several people to work on the same files

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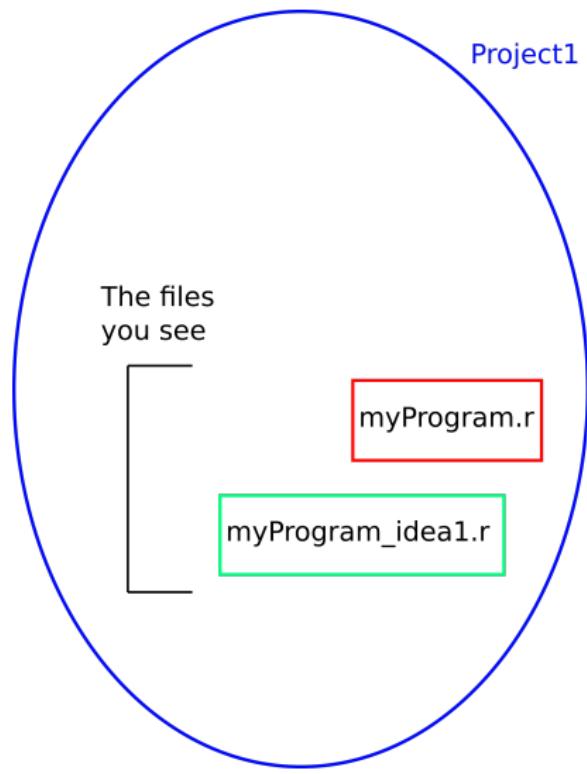
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With revision control, you only have

- ▶ Project1/myProgram.r

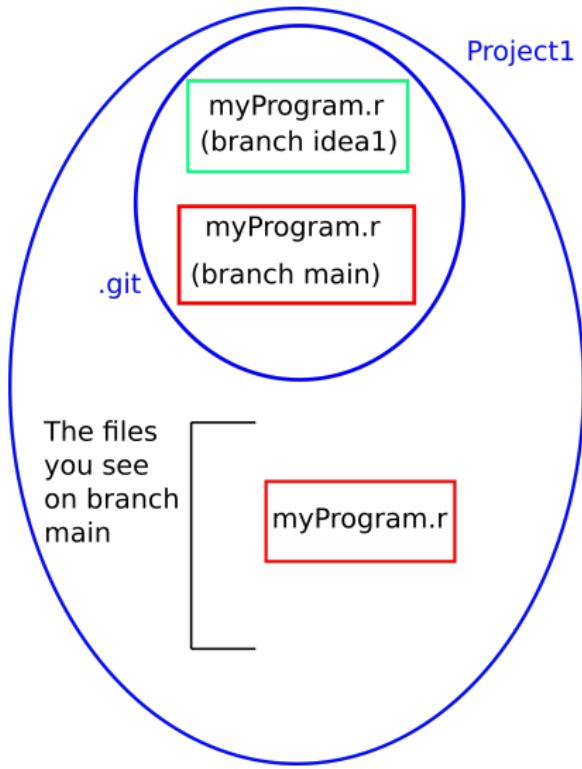
## File versions

- ▶ Ellipses are folders (aka directories)
- ▶ Boxes are files



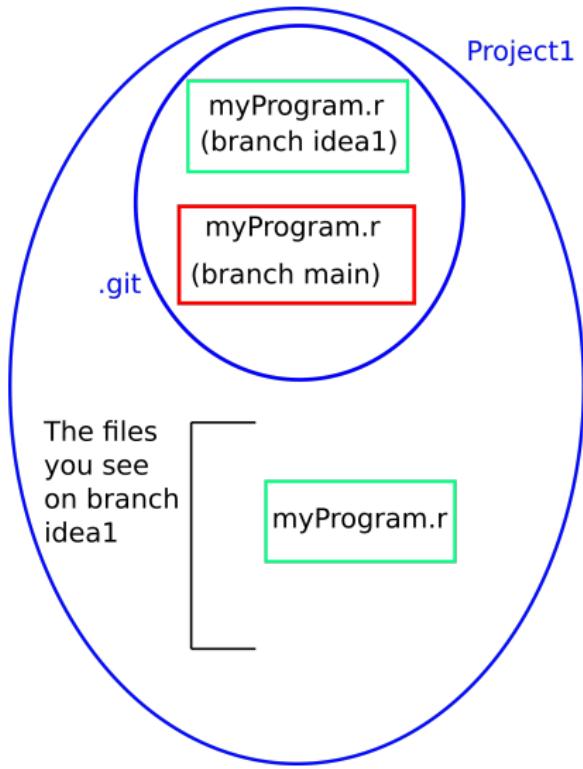
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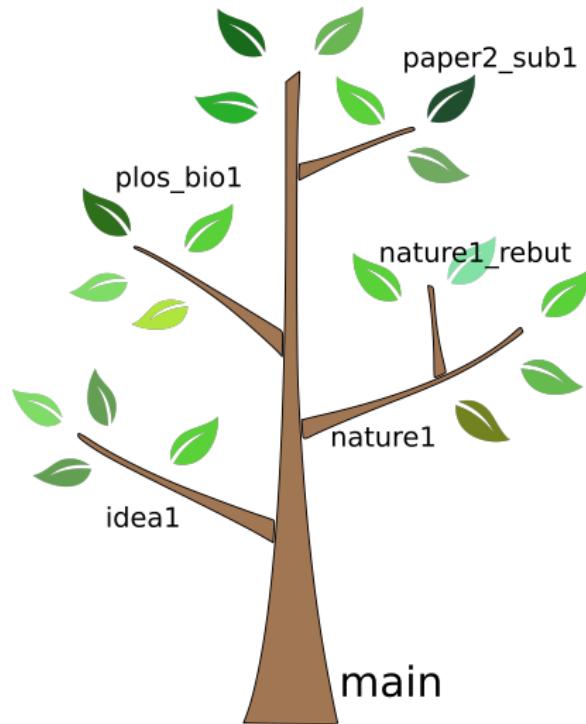


# Branches instead of file versions

When you use git, you use **branches** to work with different file versions. There's one central branch, which is usually called **main**.

## Clone

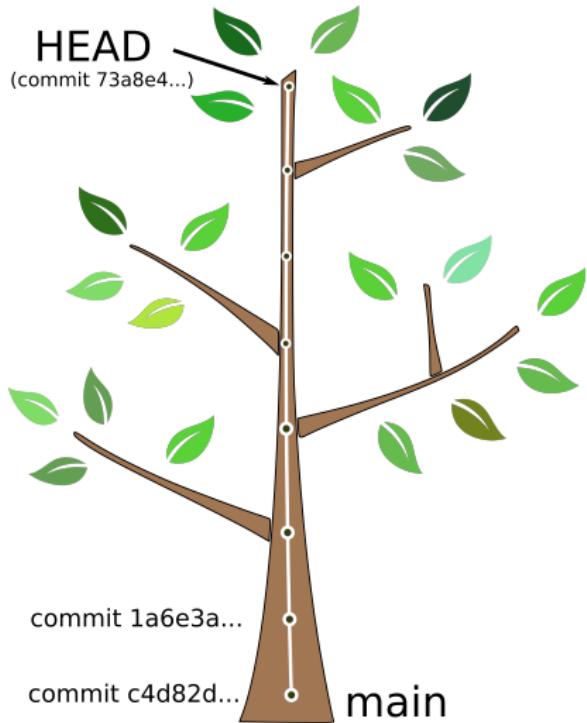
- ▶ When you **clone** a repository from github, you'll get all **myProgram.r** as it exists on the **main** branch
- ▶ Also you get all the information needed to see **myProgram.r** on any of the other branches (each has a name)



# A sequence of changes on main

## Commits

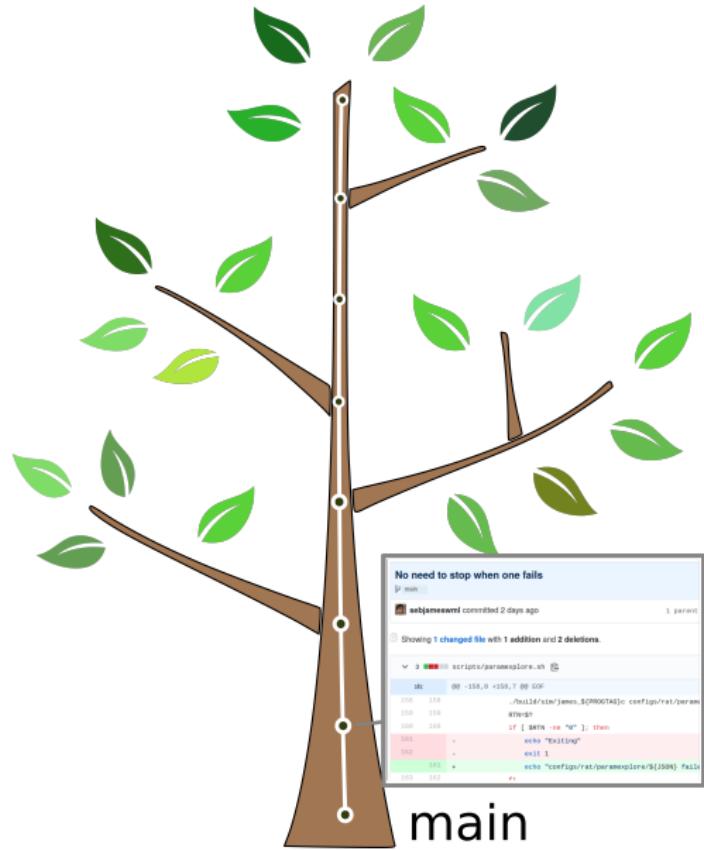
- ▶ There can be different versions of myProgram.r available on **main**; but it's a sequence of changes.
- ▶ Each change is a **commit to main**.
- ▶ Each commit has a universally unique identifier.
- ▶ When you first clone, you'll see the files at the **HEAD** of **main**



# What's in a commit?

Commits contain changes

- ▶ One commit can include the changes to one file
- ▶ One commit can also include changes to multiple files
- ▶ Each commit has a **commit message**

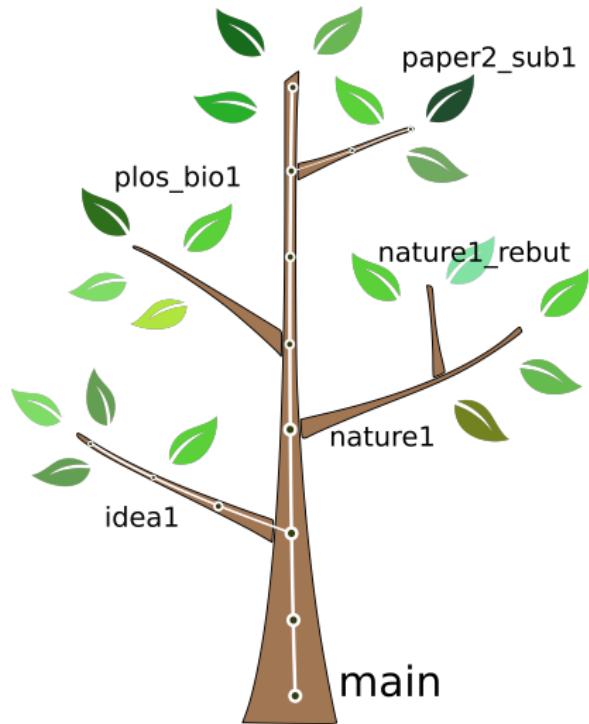


# Checkout a branch

## Checkout

When you **checkout** a branch, it updates your file to the content it has on that particular branch

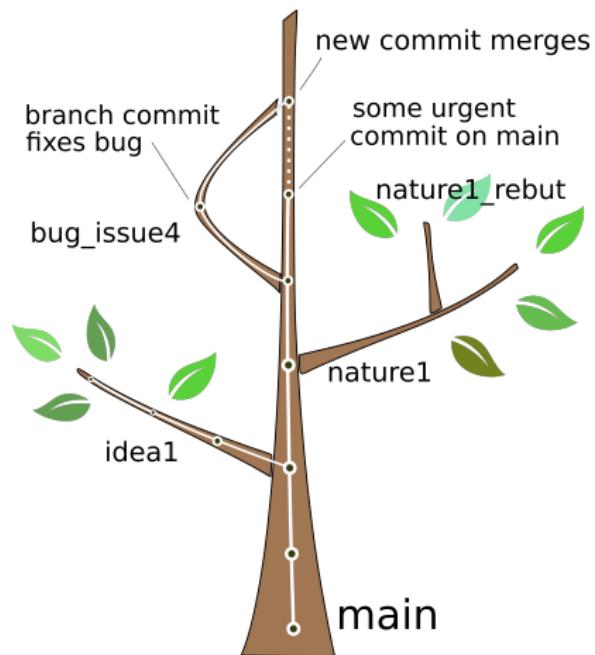
- ▶ Checkout **idea1**; get myProgram.r with the code for your first idea.
- ▶ Checkout **paper2\_sub1**; get myProgram.r as it was when you submitted your second paper based on the project.



# Merge a branch

Here's where the tree analogy begins to break down a little.

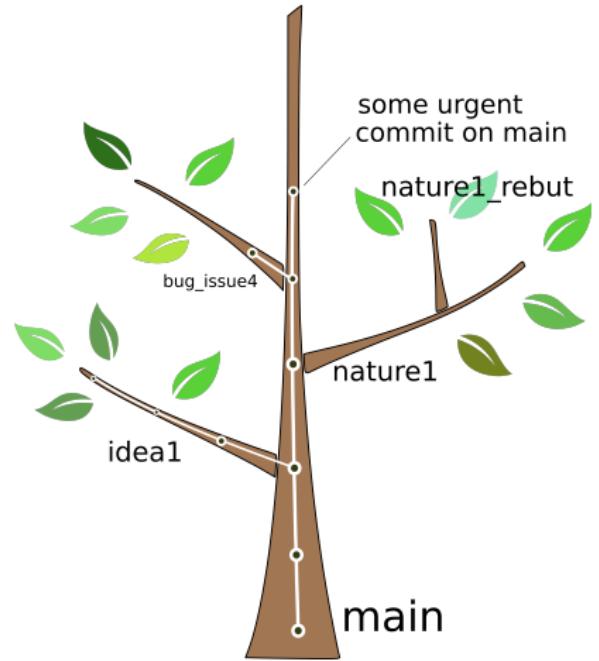
- ▶ Here, a bug was fixed on **bug\_issue4**. While that was happening, someone committed an important commit onto main
- ▶ To bring the bug fix into main, the **bug\_issue4** branch is **merged** into **main** which creates its own commit



# Rebase a branch

Rebase means get out the saw

The developer of the bug in **bug\_issue4** wants to test the bug fix works alongside the urgent commit.

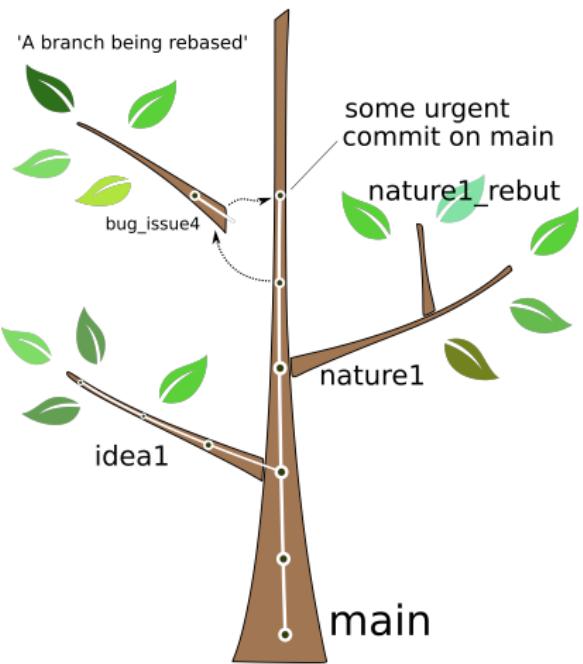


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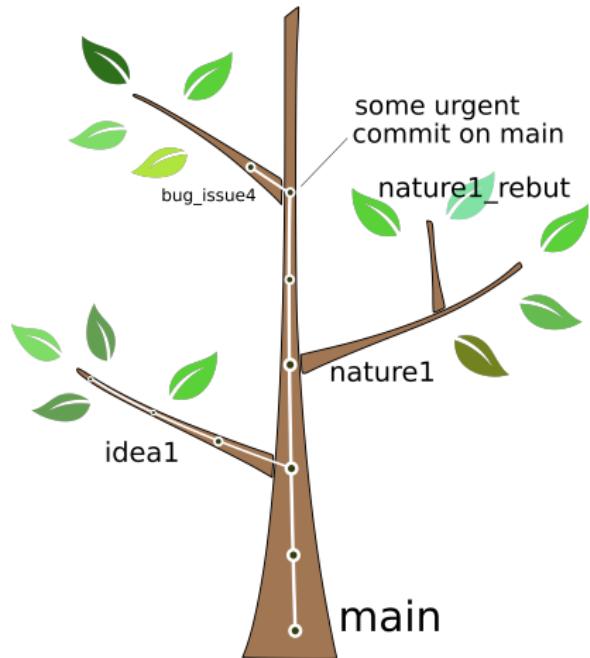


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The developer of the bug in **bug\_issue4** wants to test the bug fix works alongside the urgent commit.

- ▶ Git has a way to 'saw off' the branch **bug\_issue4** and 'glue it back onto main'
- ▶ Now the bug can be tested, alongside the recent change in **main**, before it is then merged into **main**.
- ▶ Prefer merge over rebase



## Working with other people

This is 'main feature 2'. Now, rewind a little, forget the trees, and think about working with a set of plain files on your computer.

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- ▶ Just after you emailed them, you find an error in your fix, and you have to send another email...
- ▶ Now imagine that one of your colleagues found a separate fix in the same file and emails that around. Which fix is more important? Who is going to merge the two fixes together?

This is where a central copy of the repository becomes important.

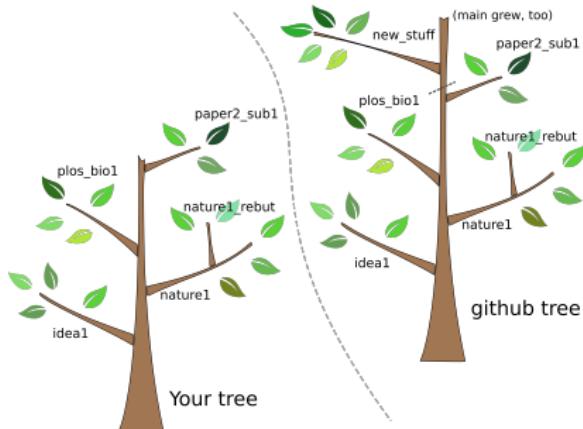
# Fetch and pull

Now imagine there is a shared tree living at `github.com`.

## Fetch

When you **fetch** new changes to the **repo**, information about new branches and commits that were added are copied into your local copy of the repo.

- ▶ Any of the existing branches could have extended
- ▶ New branches could have appeared
- ▶ You can **pull** a branch and that will always do a **fetch** first



# Push your commits

You worked on a new feature, using a new branch. You changed some existing files and added some new ones. You're ready to copy that back to github.com.

## Push

The process of copying new commits and branches as achieved with git **push**.

- ▶ You make sure you have **committed** your changes to your branch
- ▶ You **push** your branch to the online repository (i.e. github)
- ▶ If there are changes on your branch on the online repository that you don't have yet, then you'll have to pull first, **merge** changes and then push.

# Other revision control systems

Git is not the only game in town. Others include:

- ▶ RCS (Revision Control System)
- ▶ SCCS (Source Code Control System)
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Git is not the first revision control system, and its developers could draw on a lot of collective knowledge when designing it.

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- ▶ The name git doesn't really mean anything.

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- ▶ Typically you will work with a common **remote** repository (github) as your **upstream** source.

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- ▶ It's now a big business; it was acquired by Microsoft in 2018

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- ▶ You can include your paper (and your data) alongside your model code in a single, public repository
- ▶ Use of Github is a very effective way to share your published models with your peers

# The rest of the session

- ▶ Create repository on github, clone, add something
- ▶ git add, git move, git remove, git branch -D etc
- ▶ git checkout -b newbranch
- ▶ Github READMEs and markdown
- ▶ Github issues
- ▶ doxygen and codedocs.xyz
- ▶ Demonstration of branches for papers (BarrelEmerge)

For a good hands-on tutorial, head over to:

<http://sebjameswml.github.io/git-novice/>

or try the more up to date version of that 'Software Carpentry' resource at:

<http://swcarpentry.github.io/git-novice/>