Introduction to GitHub

Python-do-ECARES
Fabrizio Leone

Introduction

Why GitHub, Why Here

- GitHub helps to achieve reproducibility.
- Reproducibility is key for credible empirical research.

Some Background

- GitHub has long been the largest open source platforms for versioning. From 2018, it belongs to Microsoft.
- It has over 37M users.
- Most of the software and packages that you use are on GitHub. Python is among them.
- We use GitHub to organize our work throughout the course.

Git and GitHub

- **Git** is a version control system, i.e. a way to keep track of the whole history of things you do on a file. It is useful to save, manage and edit all the different versions of your project.

- **GitHub** is a web service that allows to conveniently work with Git. It allows you to create your own directories, see projects of other people and collaborate with them. It is like a social network, but for developers.

- GitHub offers four different subscription plans. We will work with a free one, which means that *everybody* can see what we do. However, with an academic account, you can also create private repositories with unlimited co-authors.

What It Does And Does Not Do

- No matter which subscription plan you choose, GitHub offers very limited storage space (you cannot upload files $>$ 100MB). Therefore, it is **not** suitable for storing large files (e.g. datasets). **GitHub is not a substitute for a cloud**.

- GitHub is a platform where to upload mostly **source files** (e.g. .tex, .txt, .m, .R, .do, .py, .jl, .doc,...) and light pdf.

- You can read more about Git and GitHub here and here.

GitHub Desktop

- In this course, we interact with GitHub mostly through the GitHub Desktop application.
- GitHub Desktop provides a simple yet powerful desktop interface to GitHub.
- You can download GitHub desktop here.
- You can also interact with GitHub using the Terminal (not covered in this class).

Realistic Workflow

Suppose you are beginning a new project. If you use GitHub, you can

1. Create a GitHub project with your favourite folders (e.g. code, slides, paper,...).

2. Work on your files locally and then save different versions of them on GitHub. (No more: paper_v1, paper_v1.A, paper_v2.89.x7%,...).

3. Scroll through different versions of your files when you need. Collaborate with other people. (No more: paper_v1_myedition, paper_v1_youredition,...).

First steps

Essential Vocabulary

- **Repository** are the containers of your project. They can include folders, files, images, etc. Each repository is made of one or more branches.
- The default **branch** of your repository is called *master*. One can copy the master into other branches. In this way, you can work on multiple versions of the same file in parallel.
- **Commits** are changes you make to files contained in branches.
- Commits are only displayed locally until you **push** them to a branch online.
- You can **merge** branches by opening **pull** requests.

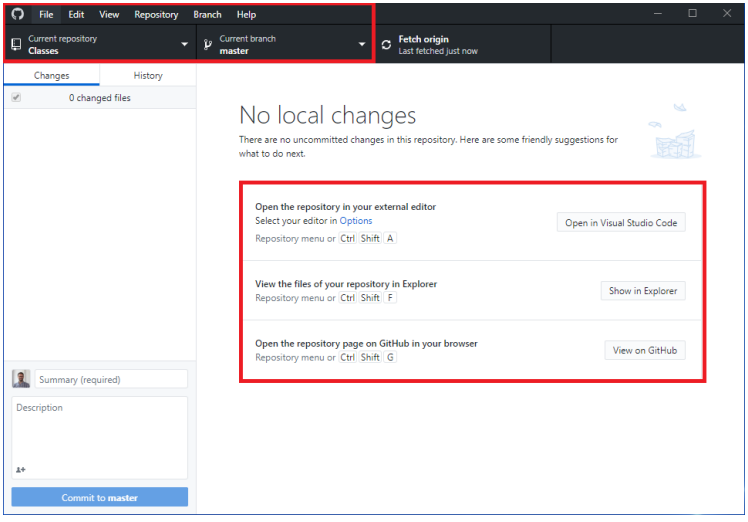
You can read more about these concepts here.

First Steps With GitHub Desktop

- You should already have (1) opened a GitHub account and (2) downloaded GitHub Desktop.

- If not, please do it now here and here.

Desktop Interface



Desktop Interface

Please take a few moments to familiarise with GitHub Desktop. It allows you to

- Manage existing repositories, create versions, see history of changes, revert changes (this class).
- Create and manage new repositories (homework).
- Collaborate with other people (try it yourself).

This Course

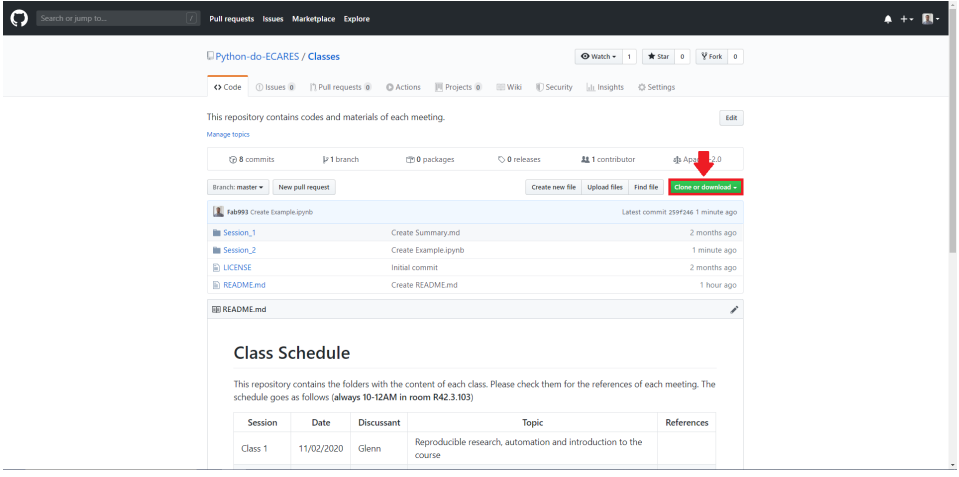
Use GitHub Desktop For This Course

- This section shows how to clone a repository, create your own branch and how to commit and push changes to it.

- Make sure to be familiar with each step. You will do this many times in the future.

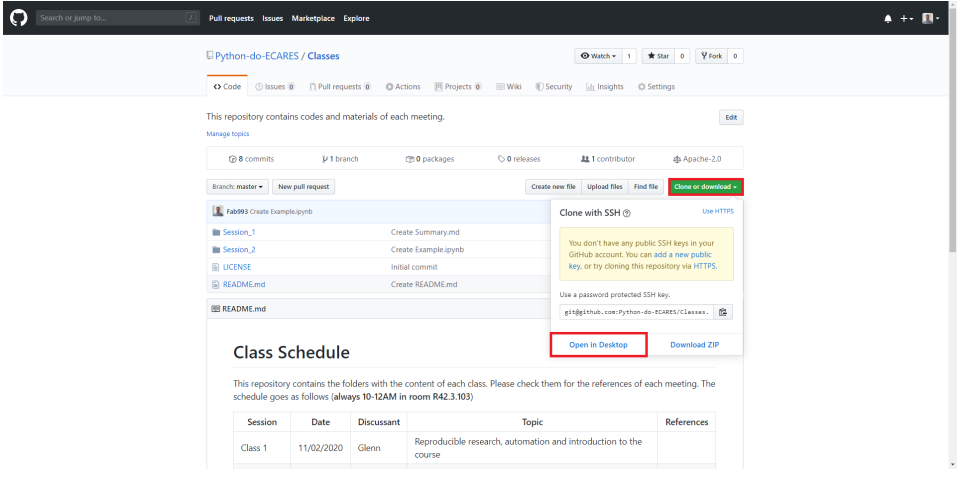
Step 1. Clone Repository

Go to the Classes repository on GitHub and click on the "Clone or download" button.



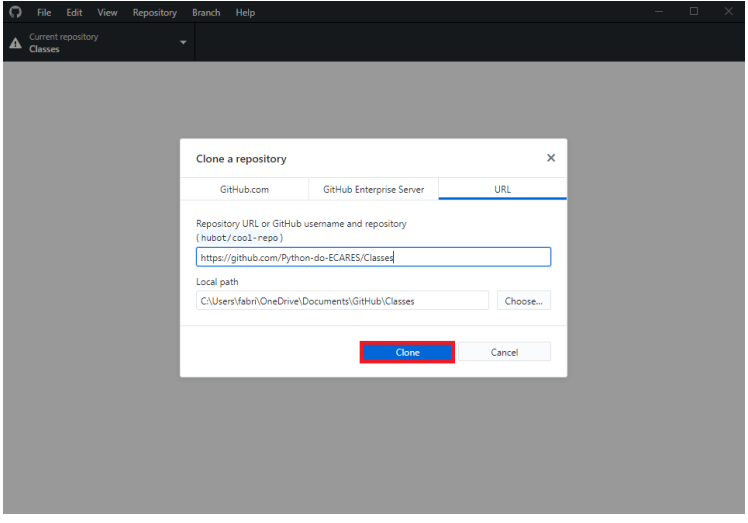
Step 1.A. Open Repository

Choose "Open in Desktop".



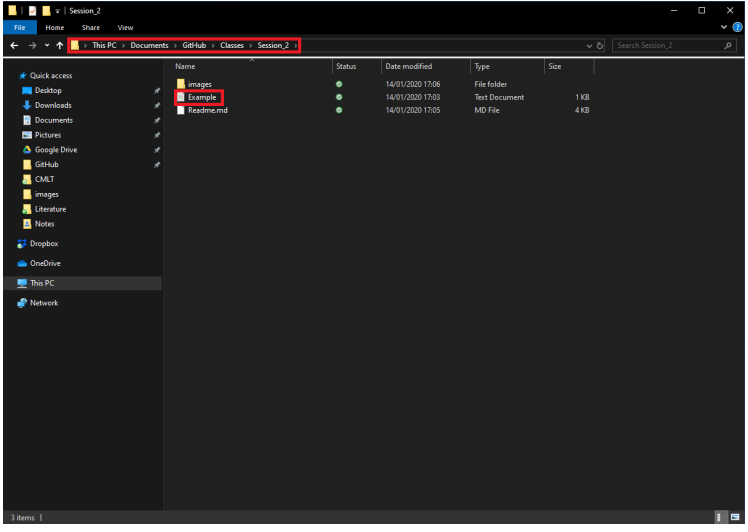
Step 1.B. Clone Repository

Check the local path where to clone the repository and hit "Clone".



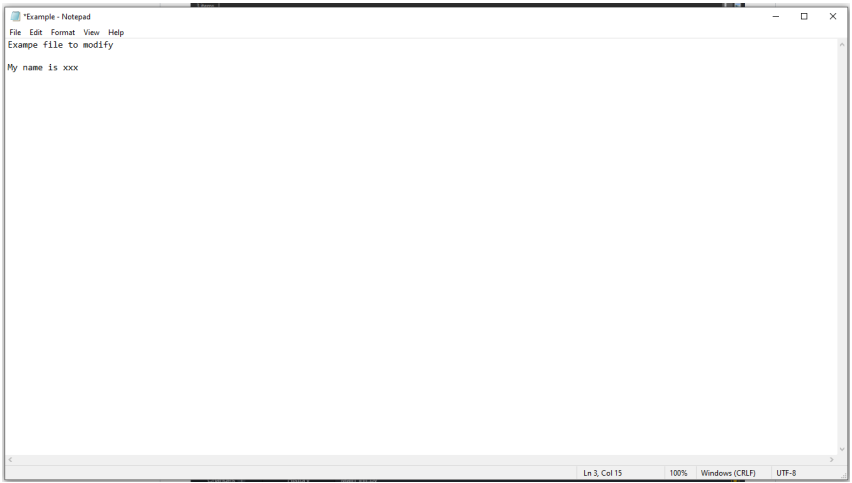
Step 1.C. Open Local Directory

Under the chosen directory, you will see the following files.



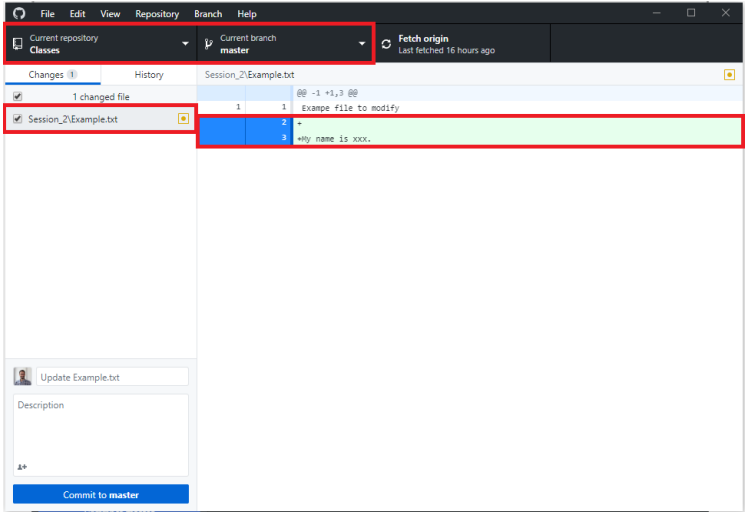
Step 2. Make Changes

Open *Example.txt*. Add a comment line with your name.



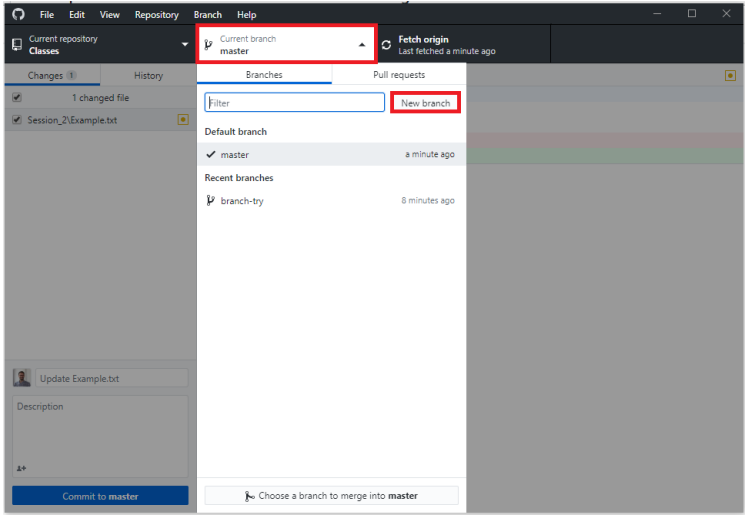
Step 2.A. Save Changes

Save the file. Changes will be displayed in GitHub Desktop as follows.



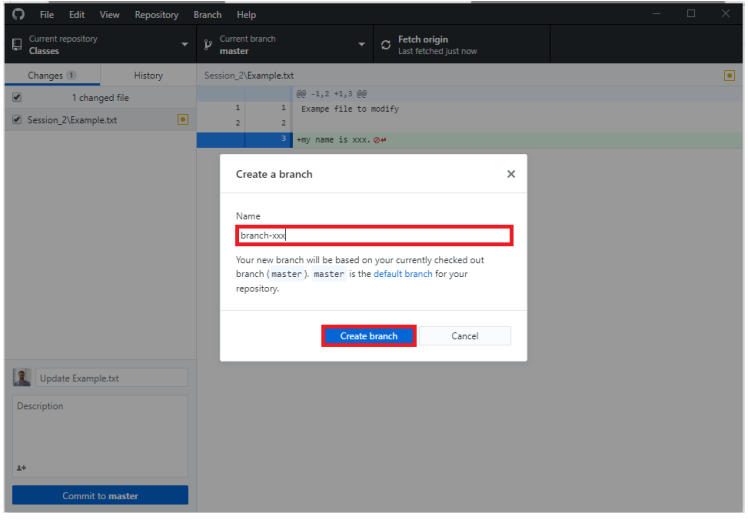
Step 2.B. Create Your Own Branch And Commit Changes

Select "Master" and hit "New Branch".



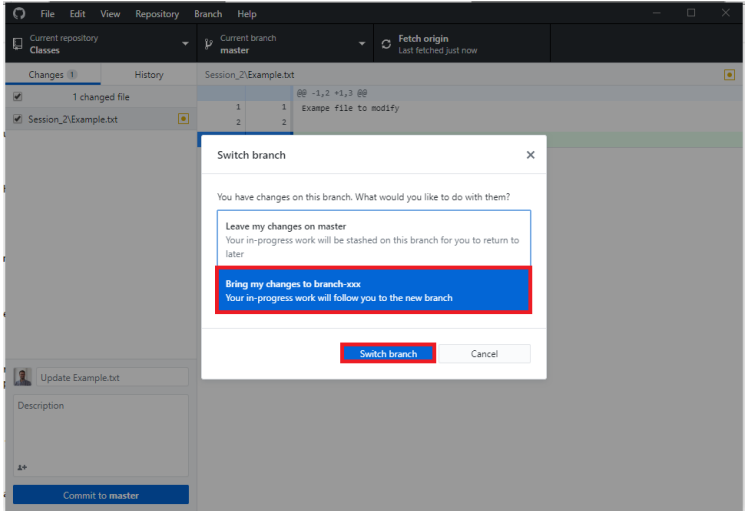
Step 2.C. Name Branch

Give the new branch your name. Then click "Create Branch".



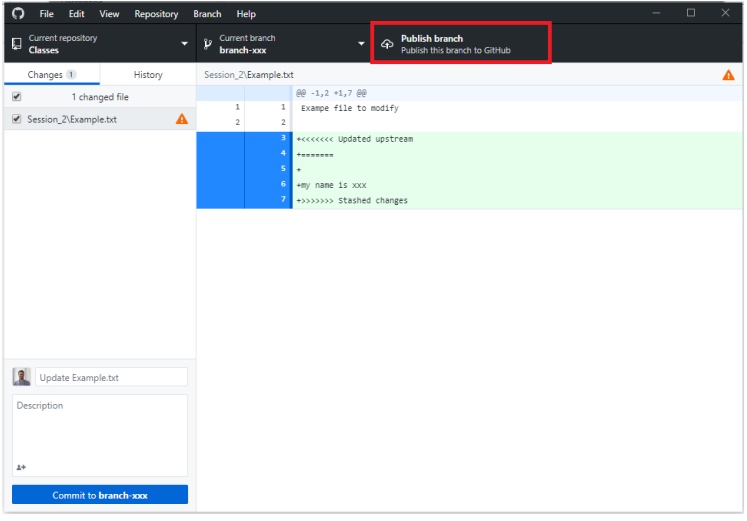
Step 2.D. Switch Branch

Switch changes to your own branch.



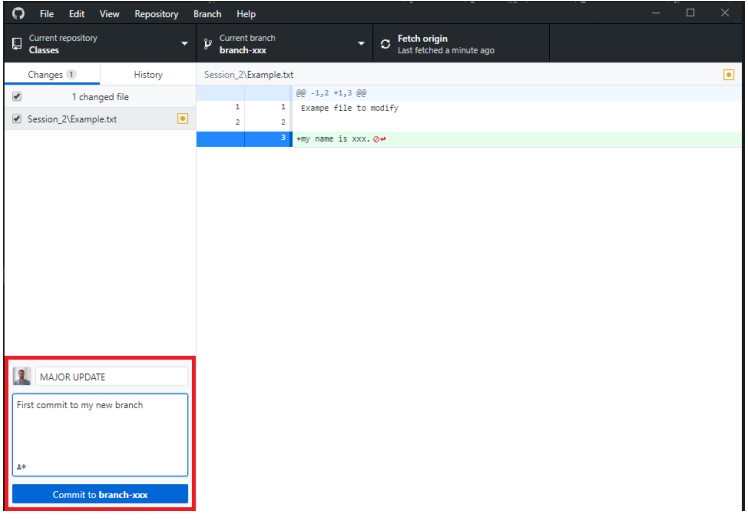
Step 2.E. Publish Branch

Publish your branch online.



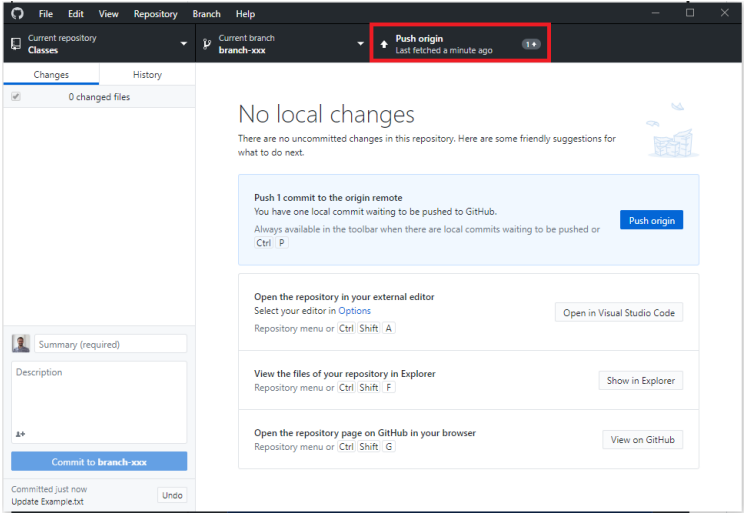
Step 2.F. Commit to Branch

Give Description and summary. Then commit.



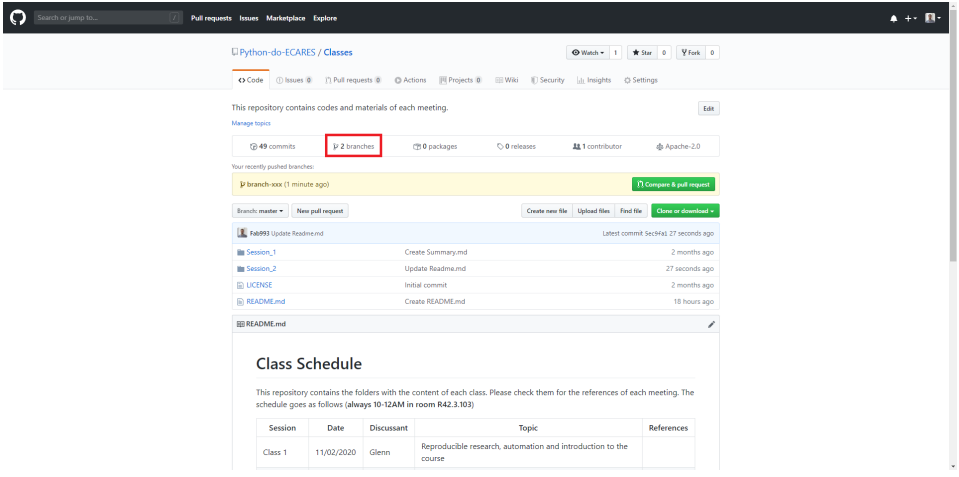
Step 2.G. Push to Branch

Push changes to your own branch.



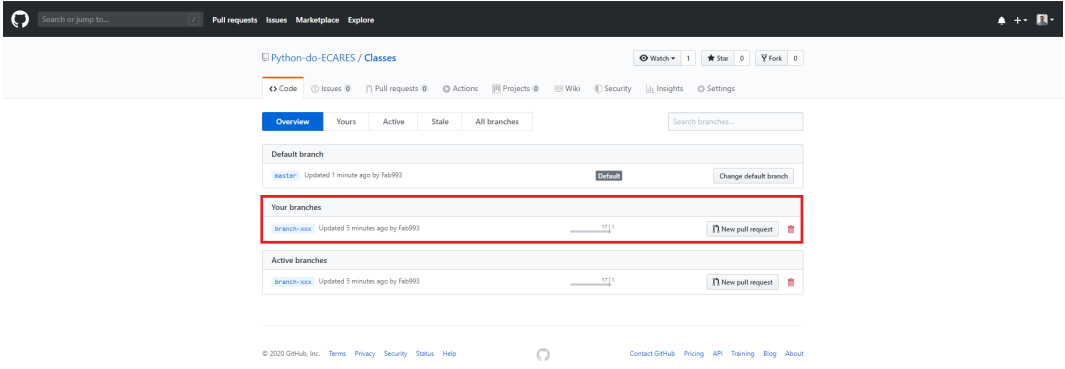
Step 3. Next Steps

Go to "Classes" page. Notice that now there are 2 branches. Click on "branches".



Step 3.A. Done!

Your directory will now appear below "branches" as follows.



Taking Stocks

- You are now able to create and maintain **your own branch** for each session of this course.
- **You are not allowed to push to the master. If you try, you will get an error.** This is a useful feature if you manage a project and do not want collaborators to modify the master directly.
- Please make sure to **only push changes to your own branch** during this course. You are encouraged to collaborate and see what other people is up to, but **never** commit changes directly to other people's branches.
- Good news is that you can always revert changes back if you do so by mistake. This is why GitHub is so useful!

Standards

Commit and Push

- **Committing** and **pushing** are two important actions that you have to familiarize with.
- *Committing changes* to a branch, means that you are creating a new version of your file.
- *Pushing changes* means, instead, that you are publishing them online on GitHub. Think of the pushing action as a way of creating different stable releases of your code.
- Only push changes online if you have made a stable change.

Commit and Local Saving

- Notice that **committing to GitHub** and **saving your file locally** are very different things.
- If you save locally, you only change the file on your device. If you commit, you add a "node" to the chain of your versions.
- With this respect, we recommend to commit changes regularly, but also to use **standards**.

Commit Standards

- We encourage you to adopt the following standards to commit tidily.
- "Summary" should be either **Minor Change**, **Major Change** or **Bug Fixes**. The first should indicate small changes in syntaxis or general improvements. The second to major modifications (e.g. add new section or function), while the third is to notify that you have fixed some bug.
- **Description** should briefly explain what the summary refers to.

Commit Standards

- Suppose you **create a new function for data cleaning in your code**. When pushing this change to GitHub, you want to give **Major Change** as summary and ”added function for data cleaning” as description.

- A tidy commit activities will create a full history of changes in GitHub that you can scroll through to check different versions of your code.

- Finally, it will also help other people to understand your work.

Browse History

Browse Through History Of Changes

With GitHub Desktop, you can also browse through the entire history of your commits. This is very helpful to

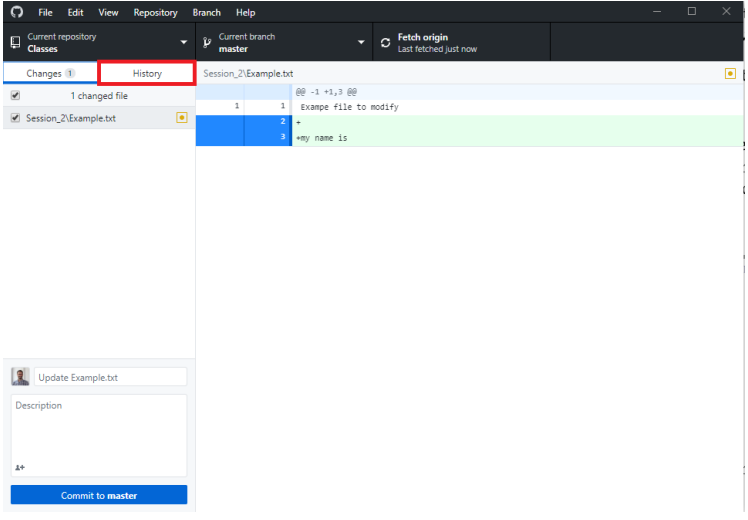
- **Revert back changes**. Imagine you update a code but, at some point, you realise that one of the previous releases was better.
- **Compare different versions**. From time to time, you may want to look back at previous versions of your work (slide, paper, code,...).

Commit Folk Theorem

A tidy committing activity will help you to easily browse through meaningful versions of your work. If you commit too often, you have to search a lot (versions only differ marginally from one another). If you commit too infrequently, you may lose information.

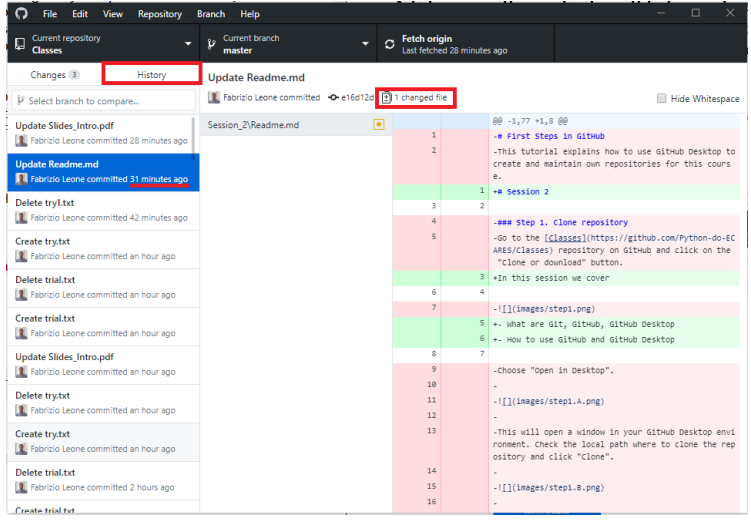
Revert Back Changes

Step1. Open GitHub Desktop at the current repository. Then hit ”History”.



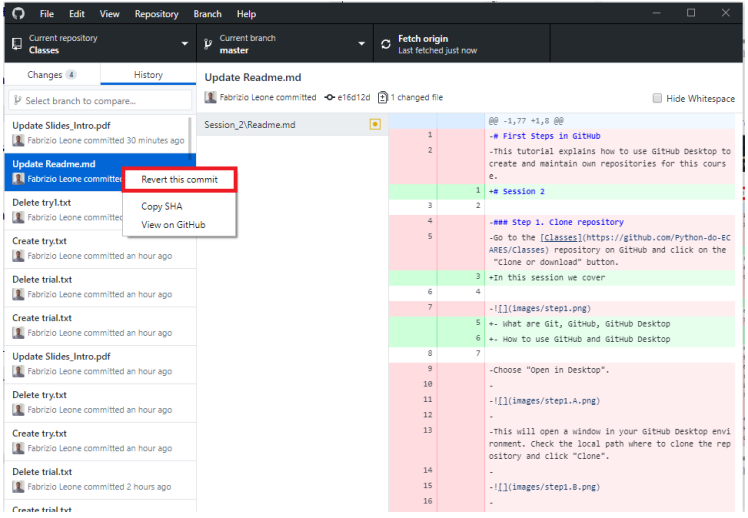
Revert Back Changes

Step2. Scroll through the whole history of changes that you have made up to that moment.



Revert Back Changes

Step3. Find the node you want to restore. Click on "Revert this commit" to go back to that version.



More Details

- You can switch back and forth your versions as many times as you want. **Your local directories will change accordingly**.

- If instead of ”Revert this commit” you hit ”View on GitHub”, you can see online all the differences between two versions of your file.

Homework Management

Homework

- You now know the basics to manage your homework (and your research) with GitHub.
- If you have to **present**, please send your material to Glenn, Federico or myself after the meeting. We will upload it on the master.
- Do your homework before each meeting, and keep track of what you do using GitHub.

GitHub For Homework

- We will upload the exercises for each session on GitHub. You can find them here.
- Installing GitHub Desktop has created a folder called “GitHub” on your computer. Make sure to locate it conveniently for you.
- For each session, create and save there your solutions inside the corresponding folder
- While working on them, keep GitHub Desktop opened and get acquainted with commit, push and description actions.
- **Remember to commit to your own branch only**.

More Functionalities

More Functionalities

Other useful GitHub functionalities you may want to check

- Communicate with other people (your coauthors, other developers, etc.) by creating issues.
- Pull and merge different branches. This is particularly useful for collaboration.
- Automatic workflow. No need to manage your work manually.
- Create a website.
- Create a Project Board.
- GitHub integrations for R Studio, VS code and Atom editors.
- Gitignore files.

Conclusion

Conclusion

- GitHub and GitHub Desktop are powerful tools that help you to organize and make your research reproducible.
- **GitHub features a bit of a learning curve**. First commits will be quite messy: you will likely commit too often, you will create too many branches and you will be tempted to modify things from the web interface rather than from GitHub Desktop (or the terminal).
- Before adopting your own standards, **see what more experienced people do**. There are plenty of web articles that suggest best practices and standards for GitHub.
- Use GitHub to organize your research from the very initial step until the end. Sooner or later you will like it.

Exercises

Exercises

Try to do the following at home.

- Familiarise with GitHub online. Search for people, projects and browse directories.
- Use GitHub Desktop to create a new directory on your own GitHub profile.
- Create a new branch and call it “branch-try”. Open an issue an assign it to yourself. Familiarize with mentions and comments. Then close the issue.
- Create a new file (e.g. .txt) on your branch. Then, use GitHub Desktop to open a pull request. After merging the two branches, delete “branch-try”.