Version control with git for Mathematicians

https://github.com/gabindu/git-intro

Gabriel Indurskis, based on slides by Max Joseph

January 29, 2020

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3. How much would your science/teaching/life suffer if your workstation exploded right now? (scale from 1-10)

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What is git

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- collaborate with other people
- in principle a commandline tool, but can use convenient graphical interfaces and websites (GitHub/GitLab/BitBucket)
- many modern editors support it directly without the need of external software

"Always remember your first collaborator is your future self, and your past self doesn't answer emails"

- Christie Bahlai

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2. GitHub Desktop: a simple & very convenient GUI

   Optionally, create yourself an account on GitHub and log in on GitHub Desktop. (We will actually use GitLab for most things, but having access to GitHub directly is nice as well.)

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    - if you use Emacs, install `magit` package.

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    `~/.ssh/id_ed25519.pub` (or maybe `id_rsa.pub` if you already had an older key)
  - in Git Bash, you can use the command
    `cat ~/.ssh/id_ed25519.pub | clip`
    to easily copy the relevant text.

Command line git

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Somewhere on your computer, create a new directory with a (text) file, e.g. test.tex or test.txt, and fill it with some example content (at least a few lines). (You could also just copy an already existing document.)

You can do this with your usual methods, or on the commandline, for example with:

```
mkdir my-first-git-repo
cd my-first-git-repo
echo "This is a fancy test!" > test.txt
```

You can also create other files, of whatever type you want (LaTeX, Markdown, HTML, Python scripts, . . .) - binary files are ok as well!

Tell git to keep track of your files

Initializing a repository

On the commandline (Git Bash on Windows), make sure that you are inside the directory you created, then execute:

    git init

If you call `ls -a`, you should now notice that a hidden `.git/` directory was created. This is where git does its magic, and you should therefore never touch this directory or its contents!

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Adding your file to be tracked by git

To tell git that you want changes to the file test.txt to be "tracked", execute:

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or, to add all changed/new files (careful, this might add undesired temporary files):

```
git add --all
```

For future reference: If you want to avoid addingf temporary files (like LaTeX auxiliary files etc.), you can add a file `.gitignore` which tells git to *never* even propose to track these files. You can download an appropriate `.gitignore` file for whatever type of document you're working on at https://www.gitignore.io/
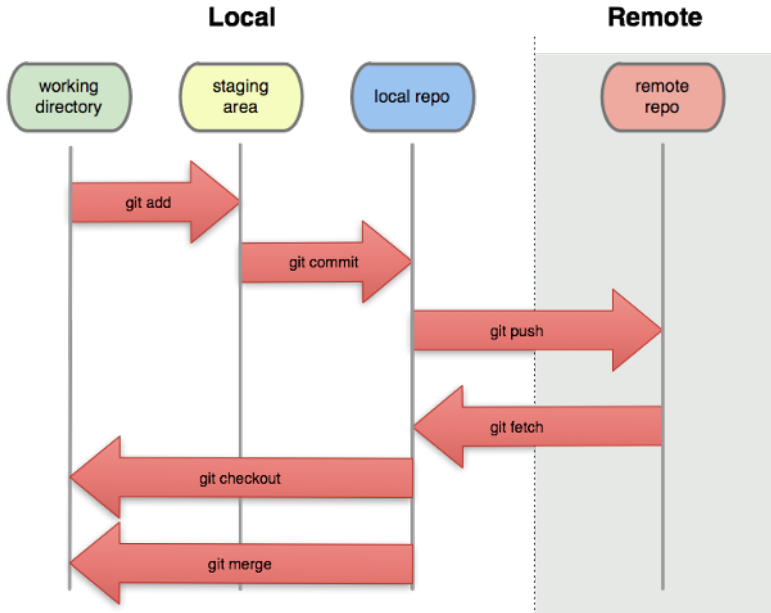
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If you just use `git commit`, git will open an editor to ask you for a commit message. You can set the default editor by one of the following commands:

```
git config --global core.editor "atom --wait"
git config --global core.editor "emacs -nw"
git config --global core.editor "zile"
```

Commit messages

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	COMMENT	DATE
○	CREATED MAIN LOOP & TIMING CONTROL	14 HOURS AGO
○	ENABLED CONFIG FILE PARSING	9 HOURS AGO
○	MISC BUGFIXES	5 HOURS AGO
○	CODE ADDITIONS/EDITS	4 HOURS AGO
○	MORE CODE	4 HOURS AGO
○	HERE HAVE CODE	4 HOURS AGO
○	AAAAAAAA	3 HOURS AGO
○	ADKFJSLKDFJSDKLFJ	3 HOURS AGO
○	MY HANDS ARE TYPING WORDS	2 HOURS AGO
○	HAAAAAAAAANDS	2 HOURS AGO

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

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5. View updated log with   git log

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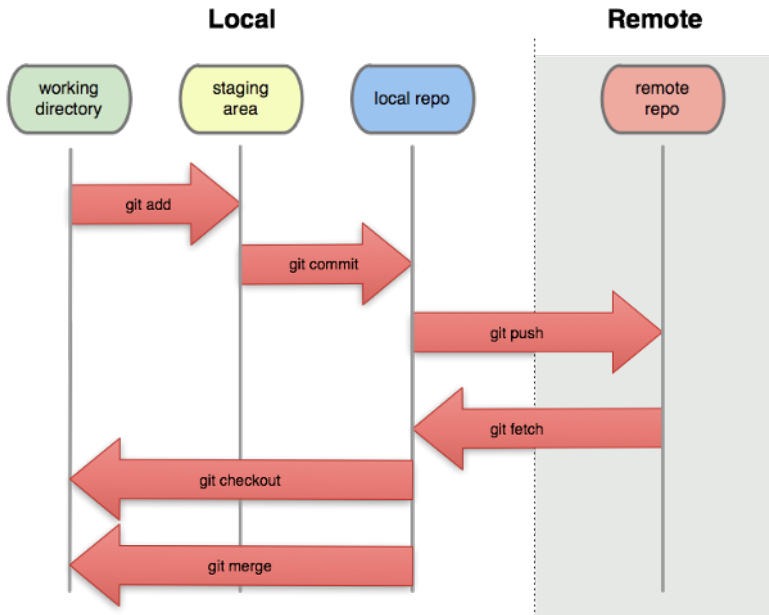- Whoops! *If only we had access to a time machine. . .*

Now, do something really stupid

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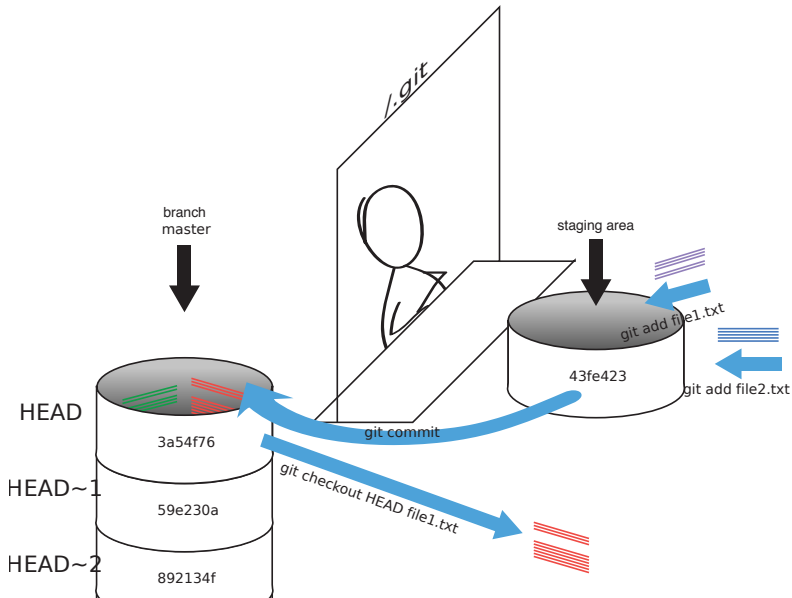- Whoops! *If only we had access to a time machine...*

- Hang on, we do!

  ```
  git diff
  git checkout HEAD test.txt
  ```

Wait, what does HEAD refer to?

Mirroring your repository on the internet

Up until now, everything has happened solely on your computer
(and in fact, only in the directory you worked in). To have a backup
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- *I personally find GitLab the best free offer at the moment - but you can use all three if you want (and you can always switch)!*

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   (use the URL shown on the website for your project, best the one using SSH, to avoid having to type in passwords all the time.)

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3. Verify the path of the remote:

   ```
   git remote -v
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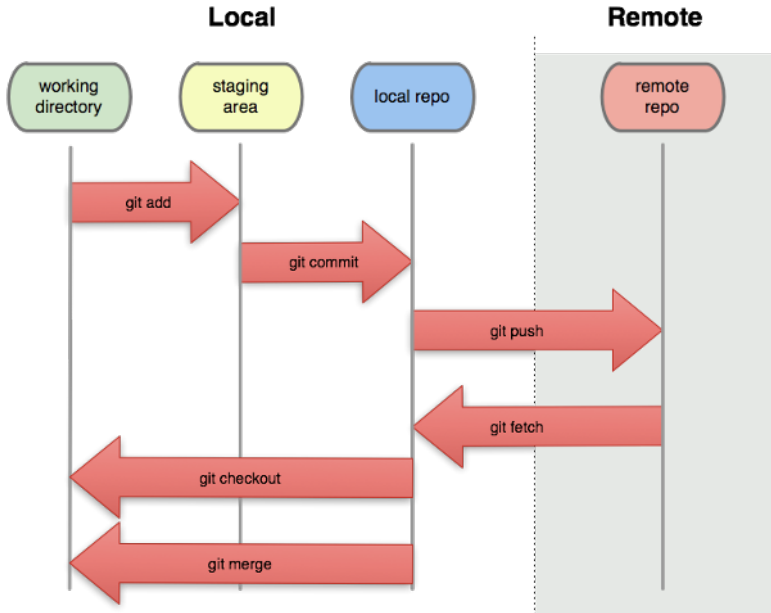
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Technical detail: `git fetch` only checks the status of the remote, while `git pull` actually applies those changes in your working directory.

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- Update the local repo from the remote with: `git pull`
- Important rule to remember: Always `git pull` before starting to edit your local files!

Find the URL of a repository you want to work on.

- For example, log into GitLab and go to the main page of our CourseOutlines-Math-ChamplainStLambert repository.

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- For example, log into GitLab and go to the main page of our CourseOutlines-Math-ChamplainStLambert repository.

- Click on "Clone" and select the URL shown under "clone with SSH" (this avoids having to type in passwords all the time).

- Now get the files onto your computer:

  - In GitHub Desktop: "Clone repository", then enter the URL (if the SSH URL does not work, try again with the https URL)

  - or, on the commandline:

    ```
    cd folder-where-you-want-it
    git clone URL
    ```

- This automatically connects your new local repo with the remote, so you can directly use `git push` and `git pull`.
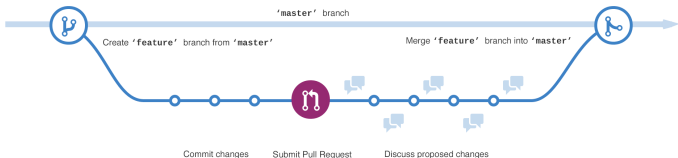
Branches

- Any repository has a default "branch" in which all files are stored, usually called "master". This branch is usually reserved for the current most up-to-date, well-working production version (good example to keep in mind: the live files for a website, e.g. http://math.mychamplain.ca)

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- But when working on new "features", it's usually not a good idea to immediately put those into the master branch!

- So, instead, you create a new branch, work in there without danger of destroying anything for others, and finally ask for the changes to be **merged** into the master branch:

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Ask for your changes to be merged into `master`

When you're satisfied with your work (and you pushed to the remote), it's time to "merge" it into the master branch. Usually, only the maintainer of the repository is allowed to do that, so you need to **create a "Pull Request"**, which is done on the website:

On GitLab:

- go to "Repository -> Branches", it should list all branches

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- fill in some details in the form to explain what you did

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- *Always* use git pull before you start editing. This pulls in any changes made by others (or yourself on another computer!) from the remote repository.

Using a graphical user interface (GUI) to git

Now that you're comfortable with the principles behind git, you are ready to do everything with a few clicks (instead of typing `git add`, `git commit`, etc. all the time)!

On Windows or Mac OS:

Install Github Desktop (if not done yet), then add "an already existing repository" from your computer. It's quite self-explicatory!

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- If you use Emacs, I recommend installing the `magit` package (ask me for help configuring it if necessary).
- Otherwise, there are many other GUIs for git available (and which might already be installed on your system, e.g. `gitk`). There is also an unofficial version of Github Desktop for Linux (which I haven't tested myself).

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- I've created a Slack group "CCSL Math Dept" for us, simply let me know if you'd like me to (re-)send an invitation.

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