Introduction to Git and Github

Computing in Optimization and Statistics: Lecture 1

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MIT

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What is git and GitHub?

- **git** is a *version control system*.
  - Other version control systems include mercurial, svn, perforce.
  - git is modern (2005) and most popular.
- **GitHub** is a service that allows you to host projects using git.

What is a version control system?

- Software that stores ”snapshots” of a project over time.
- Can be used for projects big or small, long-term or short-term.
- Allows for parallel development.

Why should I learn it?

- Everyone uses it.
- Backup (in the cloud).
- Versioning with fine granularity.
- Collaboration.

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- git gives finer granularity: files vs. lines within a file

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- **remote:** repository sitting on a remote server (i.e. GitHub).
- **pull:** grab changes from remote to local.
- **push:** update remote with local changes.

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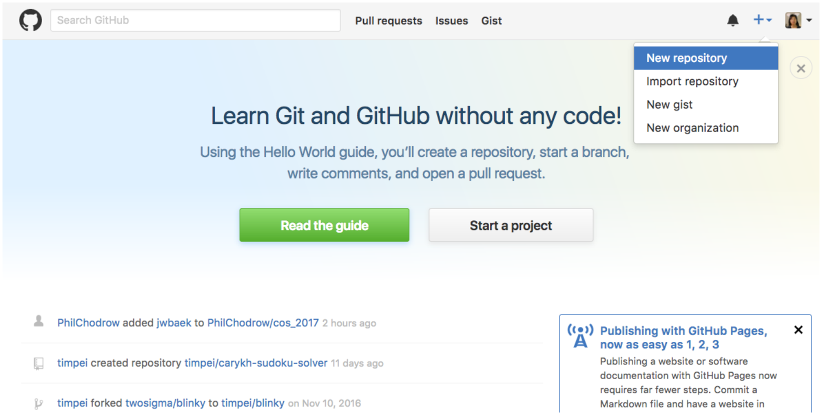
- **commit:** one snapshot of the repository.
- **local:** repository sitting on your local machine.
- **remote:** repository sitting on a remote server (i.e. GitHub).
- **pull:** grab changes from remote to local.
- **push:** update remote with local changes.
- **HEAD:** the currently checked out commit.

Creating a new repository



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.

PhilChodrow added jwbaek to PhilChodrow/cos_2017 2 hours ago

timpei created repository timpei/carykh-sudoku-solver 11 days ago

timpei forked twosigma/blinky to timpei/blinky on Nov 10, 2016

Publishing with GitHub Pages, now as easy as 1, 2, 3

Publishing a website or software documentation with GitHub Pages now requires far fewer steps. Commit a Markdown file and have a website in

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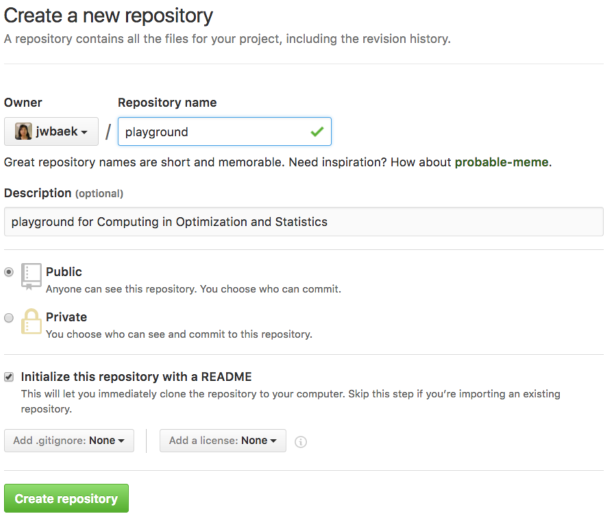

Create a new repository

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

Owner: jwbaek / Repository name: playground ✓

Great repository names are short and memorable. Need inspiration? How about **probable-meme**.

Description (optional)

playground for Computing in Optimization and Statistics

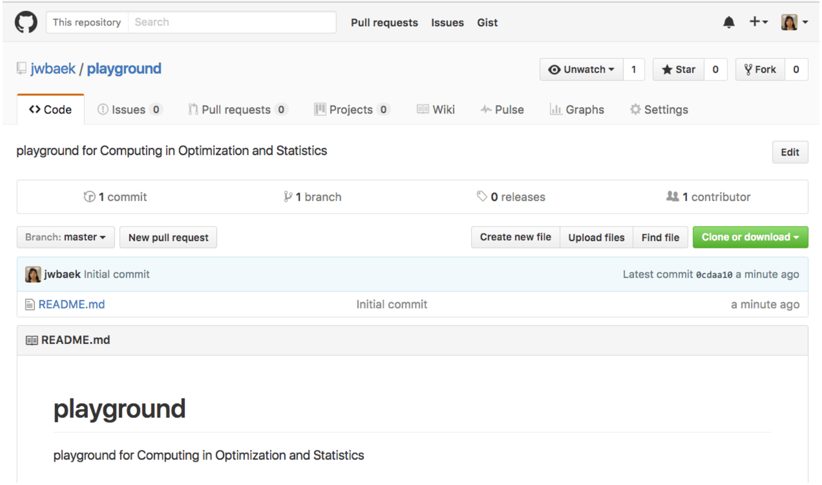
● **Public**
Anyone can see this repository. You choose who can commit.

○ **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**

Creating a new repository



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jwbaek Initial commit — Latest commit 0cdaa10 a minute ago

README.md — Initial commit — a minute ago

README.md

playground

playground for Computing in Optimization and Statistics

Cloning a repository

```
$ git clone <URL>
```

- Go to any repository and copy the URL
- This will create a new directory with the same name as the repository name and clone the repo there.

```
$ git clone https://github.com/jwbaek/playground
```

Let's make some changes

- Create a new file called new_file.txt
  - Add "This is a new file"
- Modify existing_file.txt
  - interesting → uninteresting

```
$ cd playground
$ nano new_file.txt
   This is a new file
$ nano existing_file.txt
   interesting -> uninteresting
```

Checking the status of our files

```
$ git status
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```
On branch master
Your branch is up-to-date with 'origin/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:   existing_file.txt

Untracked files:
  (use "git add <file>..." to include in what will be committed)

new_file.txt

no changes added to commit (use "git add" and/or
"git commit -a")
```

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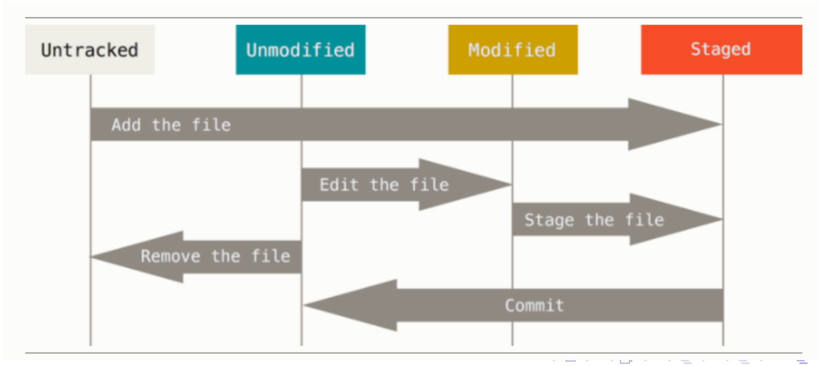
- A tracked file may be:
  1. **Unmodified:** No changes since the last commit.
  2. **Modified:** Changes have been made to it since the last commit.
  3. **Staged:** Changes will be committed in the next commit.



Staging files

```
$ git add <filepath>
```

- Any *untracked* or *modified* file that is added will be *staged*.
- Each such file will be included in the next commit.

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- Any *untracked* or *modified* file that is added will be *staged*.
- Each such file will be included in the next commit.
- Use git add to either:
  - Add a new file to the repository (untracked $\rightarrow$ staged)
  - Record a change that you made to an existing file (modified $\rightarrow$ staged)

```
$ git add new_file.txt
$ git add existing_file.txt
```

git commit

```
$ git commit -m <commit message>
```

- This creates a new snapshot of our repository with all changes that we have staged.

git commit

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- This new snapshot (commit) is saved in our local repository.
- This *does not* push our changes to the remote repository (GitHub).

git commit

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- This new snapshot (commit) is saved in our local repository.
- This *does not* push our changes to the remote repository (GitHub).

```
$ git commit -m "Added new interesting file."
```

git log

```
$ git log
```

```
commit ca82a6dff817ec66f44342007202690a93763949
Author: Jackie Baek <baek@mit.edu>
Date:   Mon Mar 17 21:52:11 2008 -0700

    this is my commit message

commit 085bb3bcb608e1e8451d4b2432f8ecbe6306e7e7
Author: Scott Chacon <schacon@gee-mail.com>
Date:   Sat Mar 15 16:40:33 2008 -0700

    removed unnecessary test

commit a11bef06a3f659402fe7563abf99ad00de2209e6
Author: Scott Chacon <schacon@gee-mail.com>
Date:   Sat Mar 15 10:31:28 2008 -0700

    first commit
```

Interacting with remote

```
$ git push
```

- Update remote repository with local commits.

```
$ git pull
```

- Updates local repository with remote commits.

Merging

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- Even if both remote and local modified the same file, git is *usually* able to correctly merge the two copies.
- We get a **merge conflict** if both parties modified the *same parts of the same file*.

Merging

```
$ git push
```

```
To https://github.com/jwbaek/playground
 ! [rejected]        master -> master (fetch first)
error: failed to push some refs to
   'https://github.com/jwbaek/playground'
hint: Updates were rejected because the remote contains
  work that you do not have locally. This is usually
  caused by another repository pushing to the same ref.
  You may want to first integrate the remote changes
  (e.g., 'git pull ...') before  pushing again.
```

Merging

```
$ git pull
```

```
remote: Counting objects: 3, done.
remote: Total 3 (delta 0), reused 3 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
https://github.com/jwbaek/playground
   50c8ec4..0c13bac  master     -> origin/master
Auto-merging existing_file.txt
CONFLICT (content): Merge conflict in existing_file.txt
Automatic merge failed; fix conflicts and then
commit the result.
```

Resolving Merge Conflicts

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$ cat existing_file.txt
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document!
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- The markers <<<<<<<, =======, >>>>>>> indicate the conflict.
- The section in between the first two markers is your local change (HEAD), while the bottom section indicates the update from remote.
- Must resolve conflict manually by editing the file, making sure to get rid of the conflict markers.

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```
$ nano existing_file.txt
```

Resolving Merge Conflicts

- After resolving conflicts, we must add the file for staging and commit again.
- Git will automatically create a commit message: "Merge branch 'master' of https://github.com/jwbaek/playground"

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```
$ git add existing_file.txt
$ git commit
```

- At this point, we can push.

Typical Workflow

```
Fetch remote changes.
  $ git pull

(If there are any conflicts, resolve them and commit.
  $ git add <conflicted files>
  $ git commit )

Make changes
Stage modified and new files.
  $ git add <files>

Commit changes.
  $ git commit -m "this is my commit message"

Push local changes to remote.
  $ git push
```

Useful tips

- Almost anything can be undone, as long as it is committed.
- Google is your friend. (e.g. "How to undo merge in git".)
- Commit often, pull often.
- Each command has many options.
    - Use ‘git <verb> −−help‘ for documentation.

Thank you!