Continuous Integration

Because you're worth it, continuously

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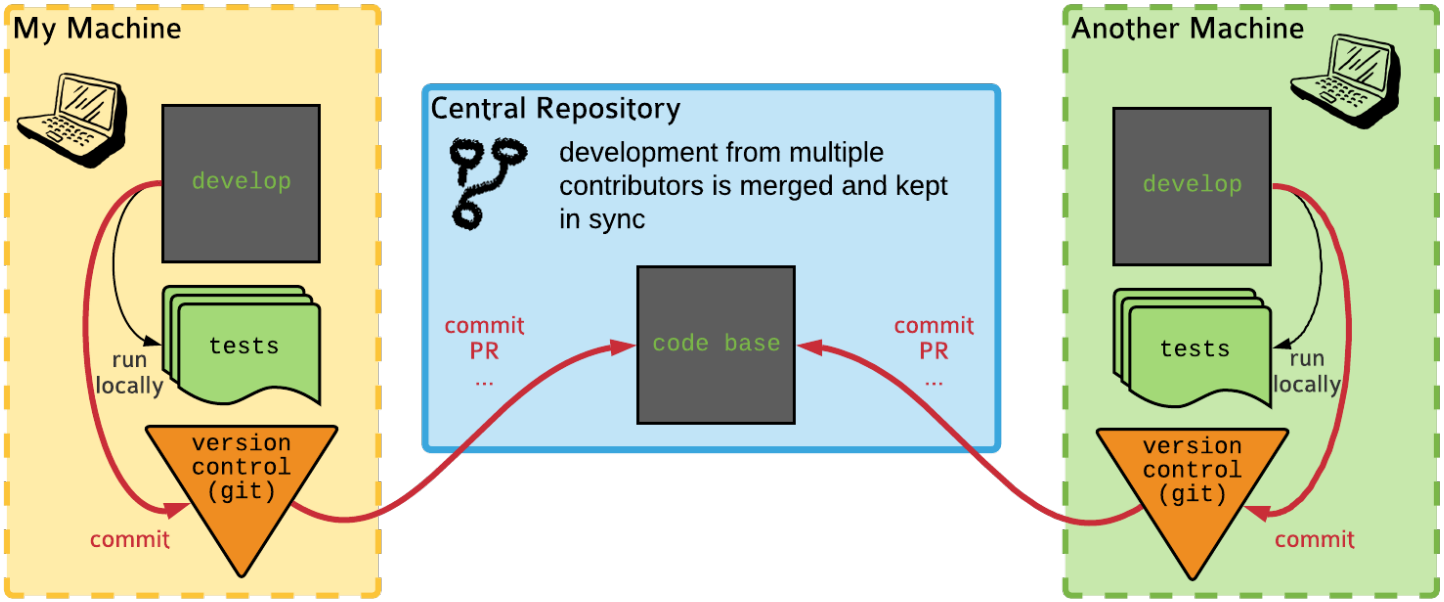
Collaborative Development without CI



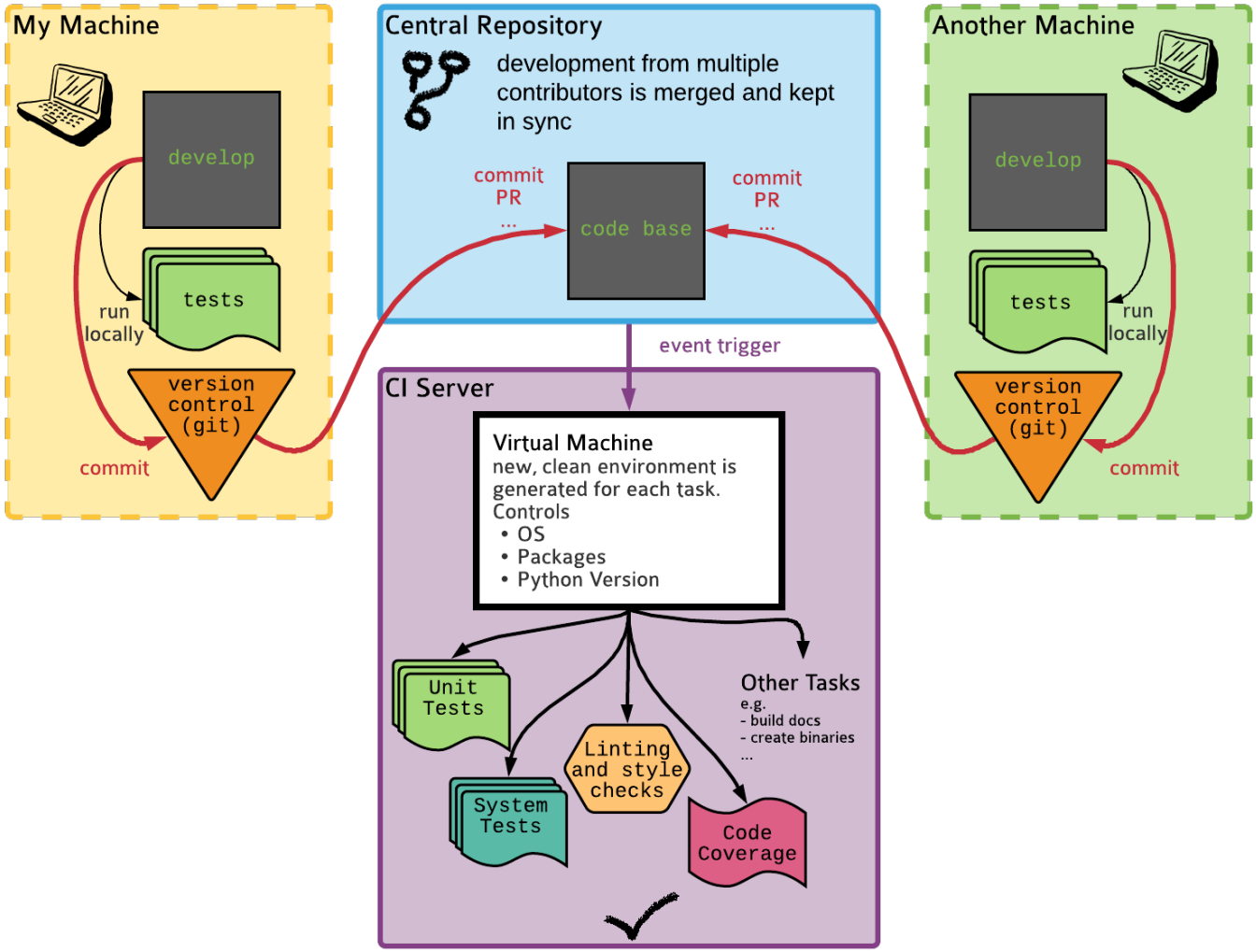
Potential issues

- The tests might pass on one machine and/or the other, but not in a third-party environment (versions, OS, etc.)
- A maintainer needs to ensure that the software works on all the supported combinations of versions / OSs
- A maintainer needs to create and upload artifacts like binary packages, documentation, etc

Continuous Integration

- Continuous Integration is a set of tools and practices to make sure that a project with many contributors (>= 1) runs smoothly
- One goal is to automatize the non-coding tasks:
  - making sure that the tests always pass
  - check for style consistency
  - build packages for distribution on multiple architectures
  - build documentation
- Another goal is to solve the "it works on my machine" problem

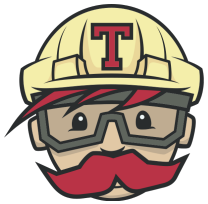
Collaborative Development with CI



The CI tasks that you'll find 95% of the time

- **Event trigger:** PR is created or a commit is pushed to master
  Tasks:
  - Run all tests for different Python versions
  - (Verify code coverage)
  - (Check code style)
- **Event trigger:** Version is bumped
  Tasks:
  - Create binary packages for Linux, Mac, Windows and upload them to a package repository
- **Event trigger:** Repository is tagged in a certain way
  Tasks:
  - Build and publish the documentation

CI options

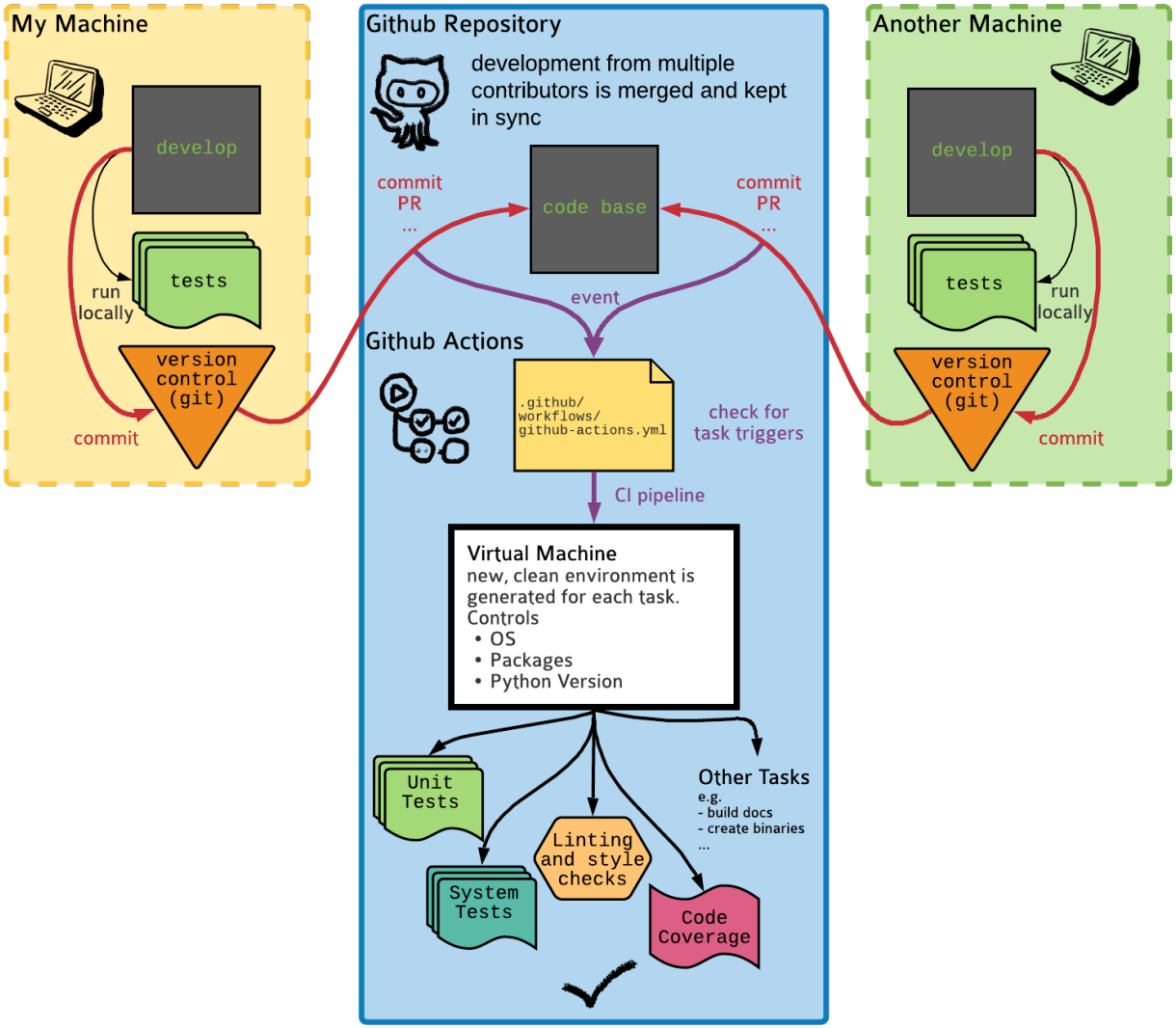


Travis CI

circleci

GitHub Actions is at the moment the preferred choice for many open source projects. It is very flexible and well integrated with GitHub.

Collaborative Development with GitHub Actions



GitHub acts as both the central repository and the CI server, but the rest is the same

GitHub Actions basic ideas

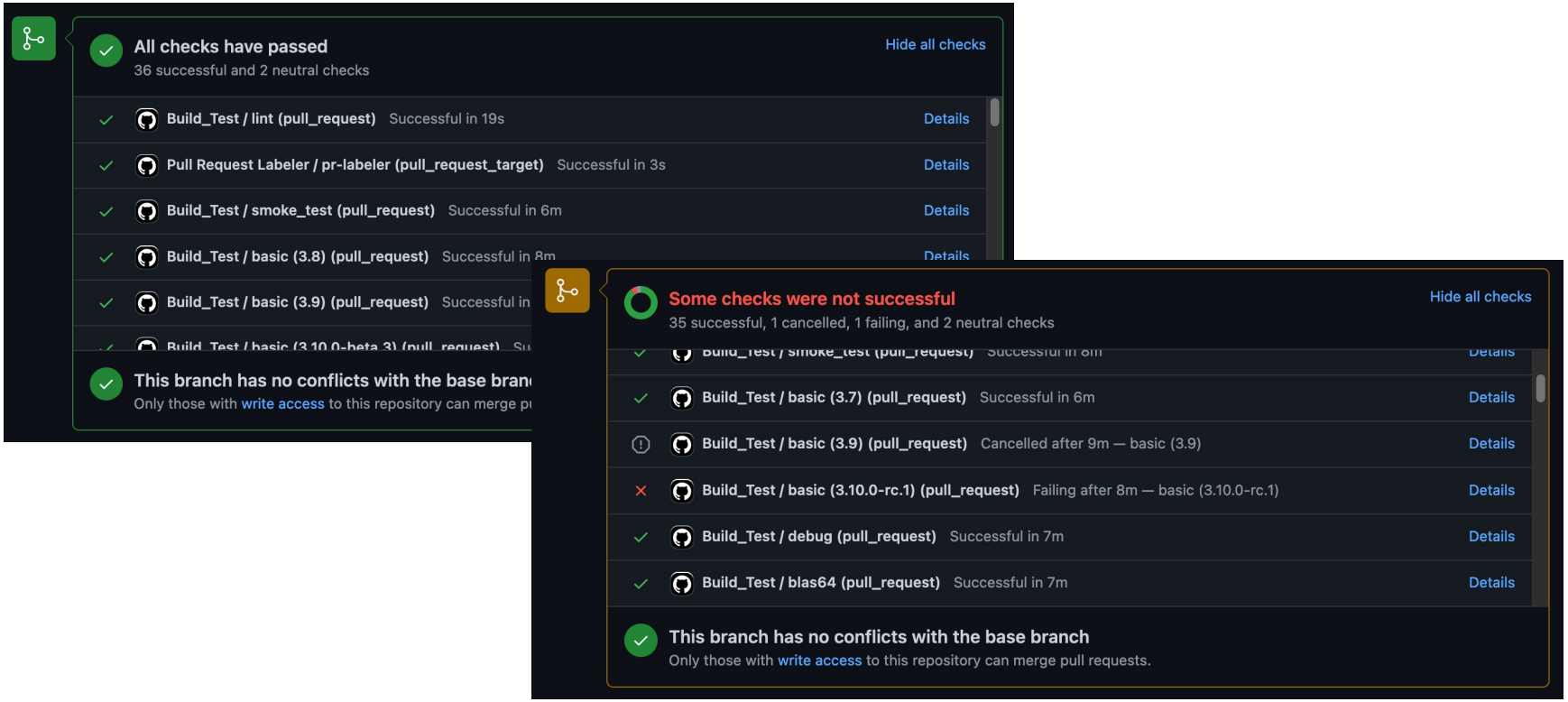
An event occurs, it has an associated commit SHA
(e.g., a PR is opened or a commit tag is pushed)

GitHub searches for config files in `.github/workflows` at that SHA, and looks if there is a trigger that matches the event

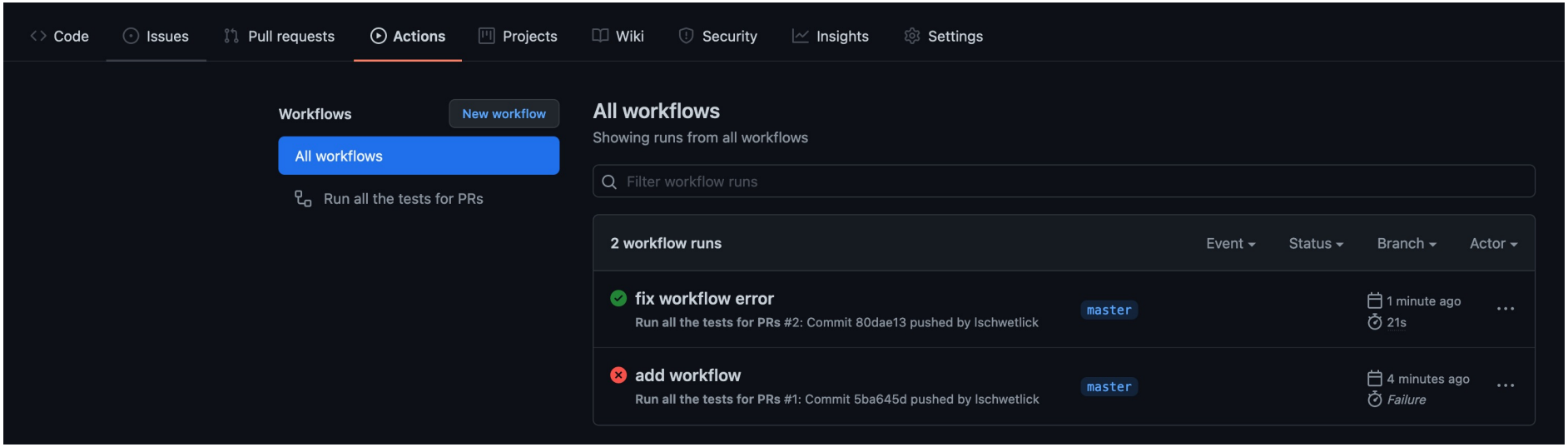
It then creates a virtual machine as specified in the config file and runs the commands listed there

GitHub Actions basic ideas

- The outcome is logged and if the job exits cleanly it is marked as ”passed” otherwise “failed”



Github Actions



GitHub config file: Simple example to run tests every time a PR is opened or a commit is pushed

The configuration file is saved somewhere in `.github/worflows/config-name.yml`

```
name: Run all the tests for PRs
on:
  [push, pull_request]

jobs:
  run-tests:
    runs-on: ubuntu-latest
    steps:
    - uses: actions/checkout@v2
    - name: Set up Python
      uses: actions/setup-python@v2
      with:
        python-version: 3.9
    - name: Install dependencies
      run:
        python -m pip install pytest numpy
    - name: Test with pytest
      run:
        pytest -sv hands_on/pyanno_voting
```

Specifies the events that trigger the jobs below

The type of virtual machine used to run the workflow

Multiple steps are used to set up the environment so that we can run the tests.
Notice the use of community actions

The command that we wanted to execute all along

GitHub Actions reference

- Introduction:
  https://docs.github.com/en/actions/learn-github-actions/introduction-to-github-actions
- Events that can trigger actions, and their config options:
  https://docs.github.com/en/actions/reference/events-that-trigger-workflows#pull_request
- Catalog of community actions:
  https://github.com/marketplace?type=actions

Hands On!

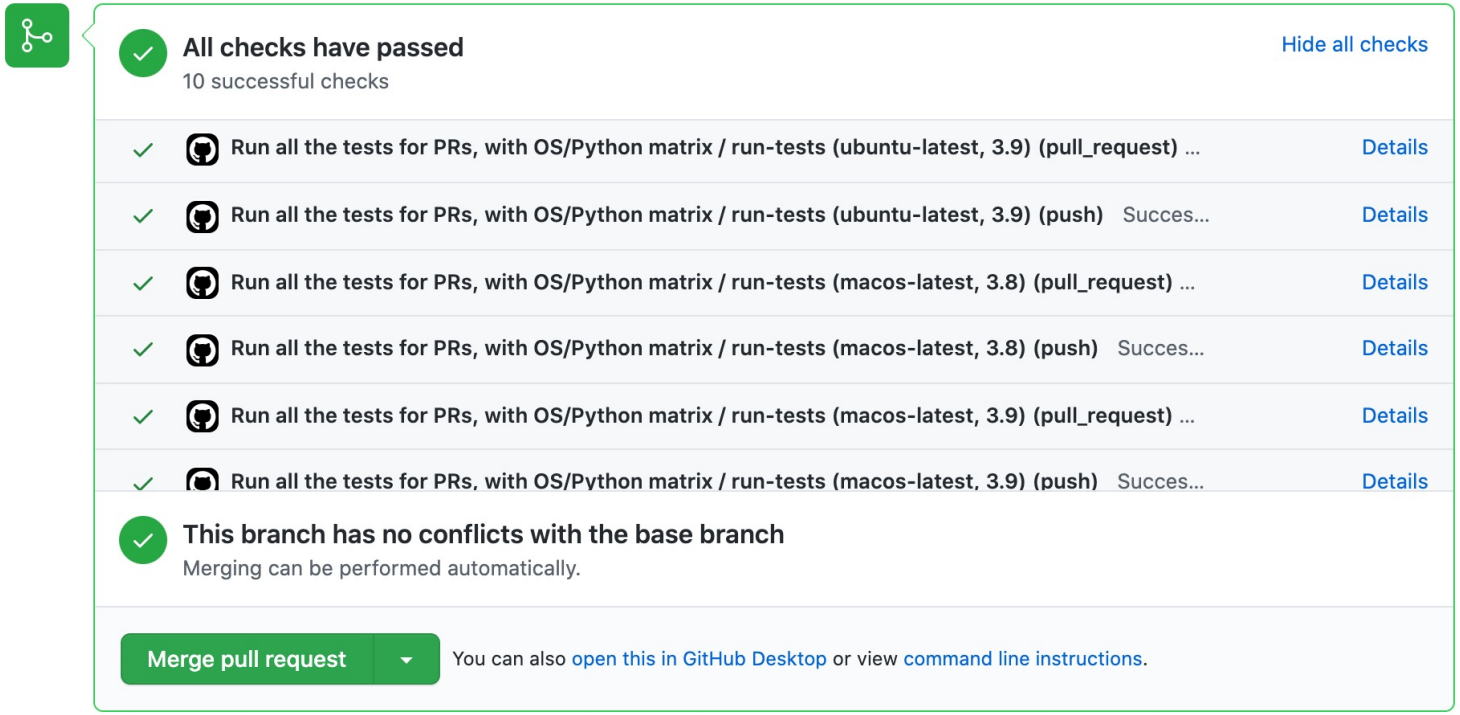
Add a CI pipeline to your logistic function project!

1. In your local version of the project make a folder `.github/workflows`
2. Create a file called `my_configuration.yml`
3. Write your configuration file to run the tests every time someone pushes some commits or every time someone creates a pull request
4. Commit and push the changes to GitHub
5. Check the actions tab of your GitHub repo to see if it worked

- Bonus: check the GitHub actions documentation and modify the configuration file so that the tasks run only for pushes and PRs against the branch `main`

Matrix configuration

- If your project supports multiple OSes, Python versions, and library version, you might want to run our tests on all the combinations of those



GitHub Actions workflow with matrix config

```
Name: Run all the tests for PRs, with OS/Python matrix

on:
  [push, pull_request]

jobs:
  run-tests:
    runs-on: ${{ matrix.os }}

    strategy:
      matrix:
        os: [ubuntu-latest, macos-latest]
        python-version: [3.8, 3.9]

    steps:
    - uses: actions/checkout@v2
    - name: Set up Python ${{ matrix.python-version }}
      uses: actions/setup-python@v2
      with:
        python-version: ${{ matrix.python-version }}
    - name: Install dependencies
      run:
        python -m pip install pytest numpy
    - name: Test with pytest
      run:
        pytest -sv hands_on/pyanno_votin
```

The strategy/matrix section specifies lists of parameters. The workflow is run for all combinations

GitHub Actions workflow with matrix config

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Name: Run all the tests for PRs, with OS/Python matrix

on:
  [push, pull_request]

jobs:
  run-tests:
    runs-on: ${{ matrix.os }}

    strategy:
      matrix:
        os: [ubuntu-latest, macos-latest]
        python-version: [3.8, 3.9]

    steps:
    - uses: actions/checkout@v2
    - name: Set up Python ${{ matrix.python-version }}
      uses: actions/setup-python@v2
      with:
        python-version: ${{ matrix.python-version }}
    - name: Install dependencies
      run:
        python -m pip install pytest numpy
    - name: Test with pytest
      run:
        pytest -sv hands_on/pyanno_votin
```

This is how we refer to the matrix parameters in the config file

GitHub Actions reference

- Types of virtual machines available on GitHub Actions: https://docs.github.com/en/actions/using-github-hosted-runners/about-github-hosted-runners#supported-runners-and-hardware-resources
- `setup-python` community action, all available Python flavors and versions: https://github.com/marketplace/actions/setup-python

Hands On!

- Adapt your configuration file and push it to GitHub
- Run the logistic function CI workflow on Python 3.7, 3.8, 3.9, and on Linux and Windows

Security

- Some tasks require "secrets" like usernames and passwords, for instance to upload the documentation to a remote machine.
- Do not push passwords and other sensitive information to a repository, not even a private one! Each CI system has a way to deal with secret safely.

Security

- Secrets in GitHub actions can be added under `Settings -> Secrets`. The secret is stored encrypted by GitHub, and decrypted at the moment of running the workflow
- Secrets can then be referred to in the workflow as

```yaml
steps:
  - name: Hello world action
    with: # Set the secret as an input
      super_secret: ${{ secrets.SuperSecret }}
    env: # Or as an environment variable
      super_secret: ${{ secrets.SuperSecret }}
```

Examples of handling secrets

```
name: Reveal a secret when the repository is tagged as something
starting by secret

on:
  push:
    tags:
      - 'secret*'

jobs:
  reveal-secret:
    runs-on: ubuntu-latest

    steps:
    - shell: bash
      env:
        SECRET_MSG: ${{ secrets.TOP_SECRET }}
      run: |
        echo The secret is "$SECRET_MSG"
        if [ "$SECRET_MSG" = 'do not tell anyone' ]; then
          echo matches
        fi
```

Details available at
https://docs.github.com/en/actions/reference/encrypted-secrets

Conclusions

- It takes a bit of time to set up and debug a Continuous Integration workflow, but it's a good investment that can save you a lot of time later on!

Thank you!