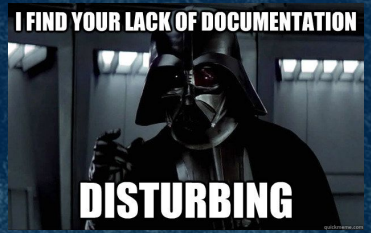
Write once, reuse often: How do you build sustainable code?

November 20, 2024
Danielle's & Magali's Docuvent



THE ERIC & WENDY SCHMIDT CENTER
Data Science & Environment

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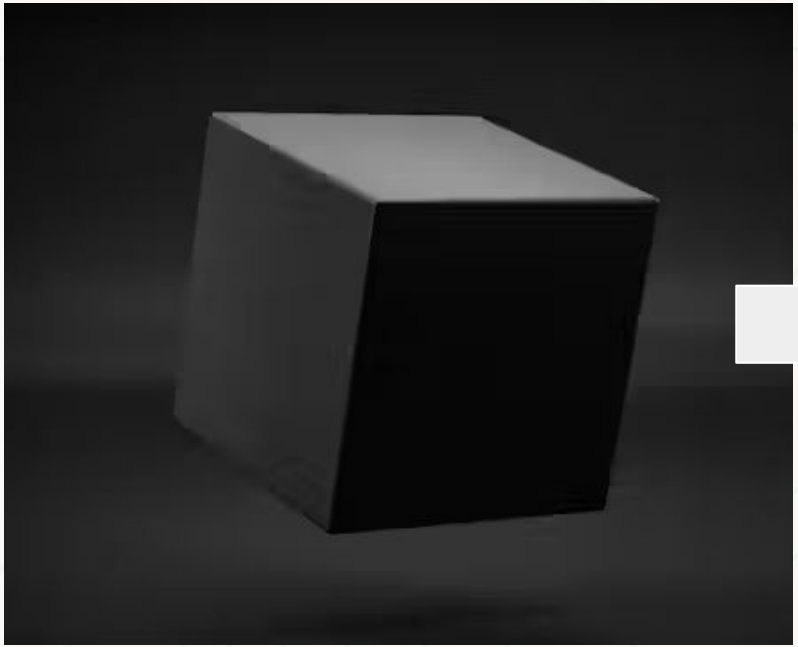
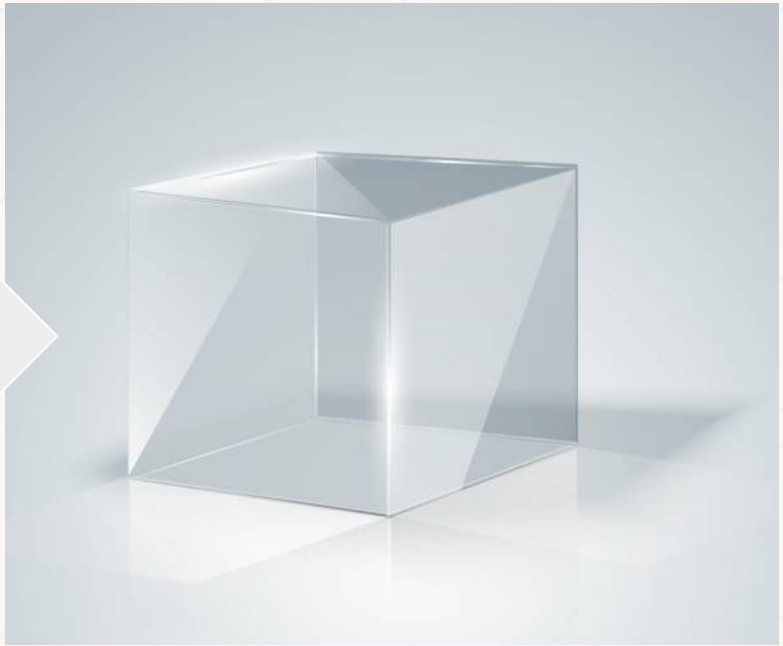
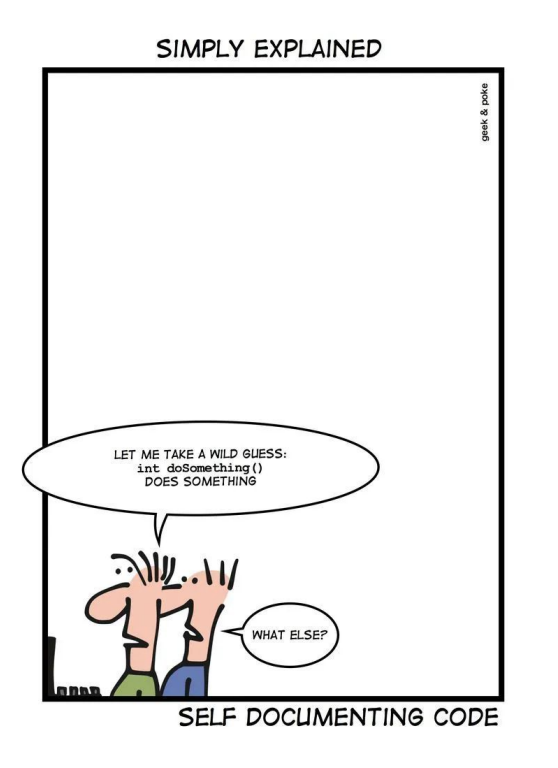
How to go from a black box to a glass box





Today's agenda

1. **Overview** of what documentation is about & why you might want to use it
2. **Best practices** of documentation: diving into specifics and items you can check off
3. A little collaborative demo **exercise & questions**



What is Documentation?

A recipe, manual, guidelines…

General Types of Documentation

Internal: for developers within an organization

External: for people outside an organization involved with the program

Low-level: within the source code and specifies specific lines/parts of code

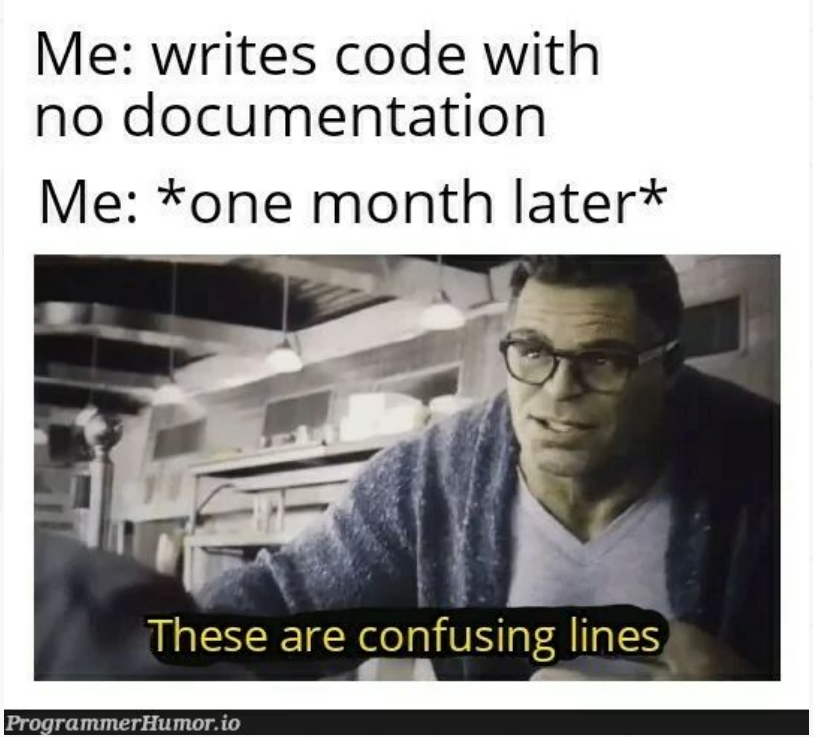
- Comments, docstrings

High-level: the overall picture → code architecture, design principles

Walkthrough: “guided tour” → identify points of interest in code

- Link between low-level and high-level

Why documentation?



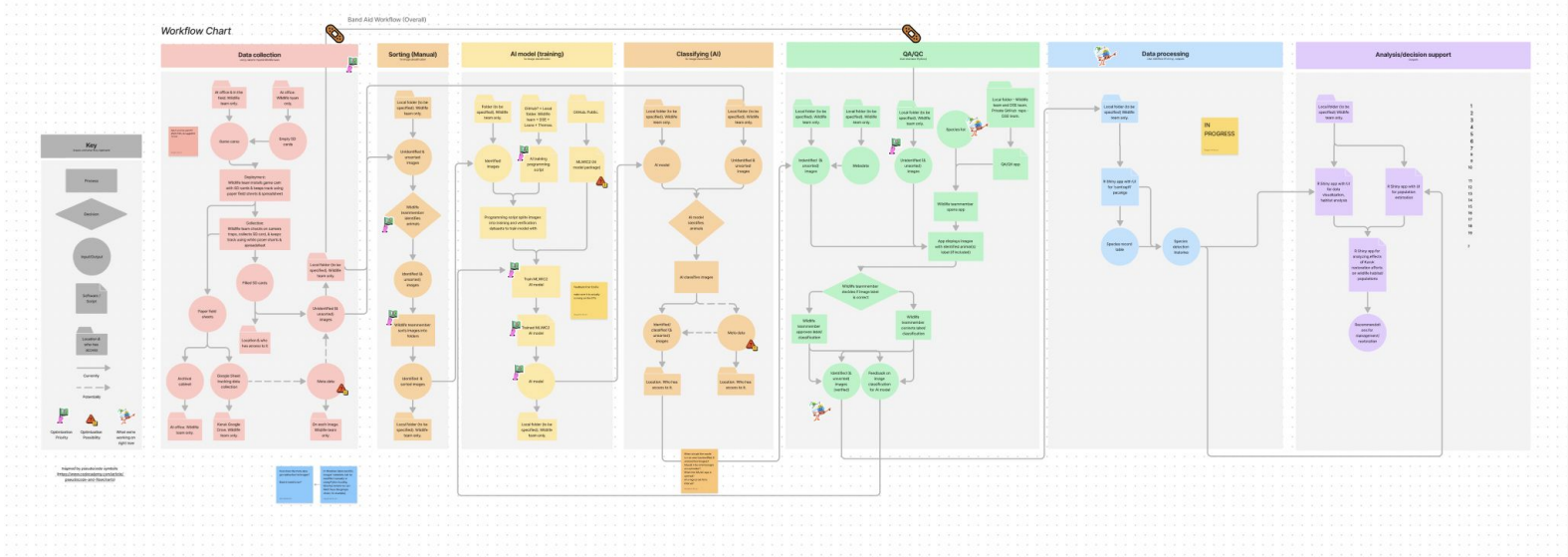
- Team projects / shared coding
- External audience
- For yourself: makes for better code, reference point, and much better debugging
- Knowledge loss and technical debt

How do you do documentation?

What are the best practices for documenting code?

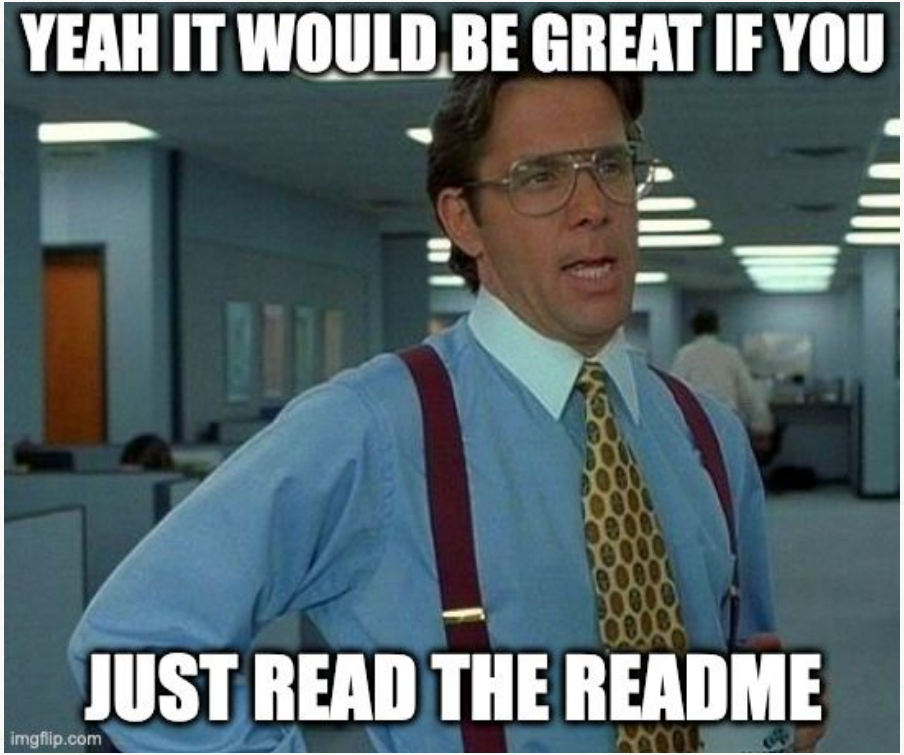
Design doc

- **Blueprints**:
  - Written/created before coding!
  - Planning, design process, initial feedback



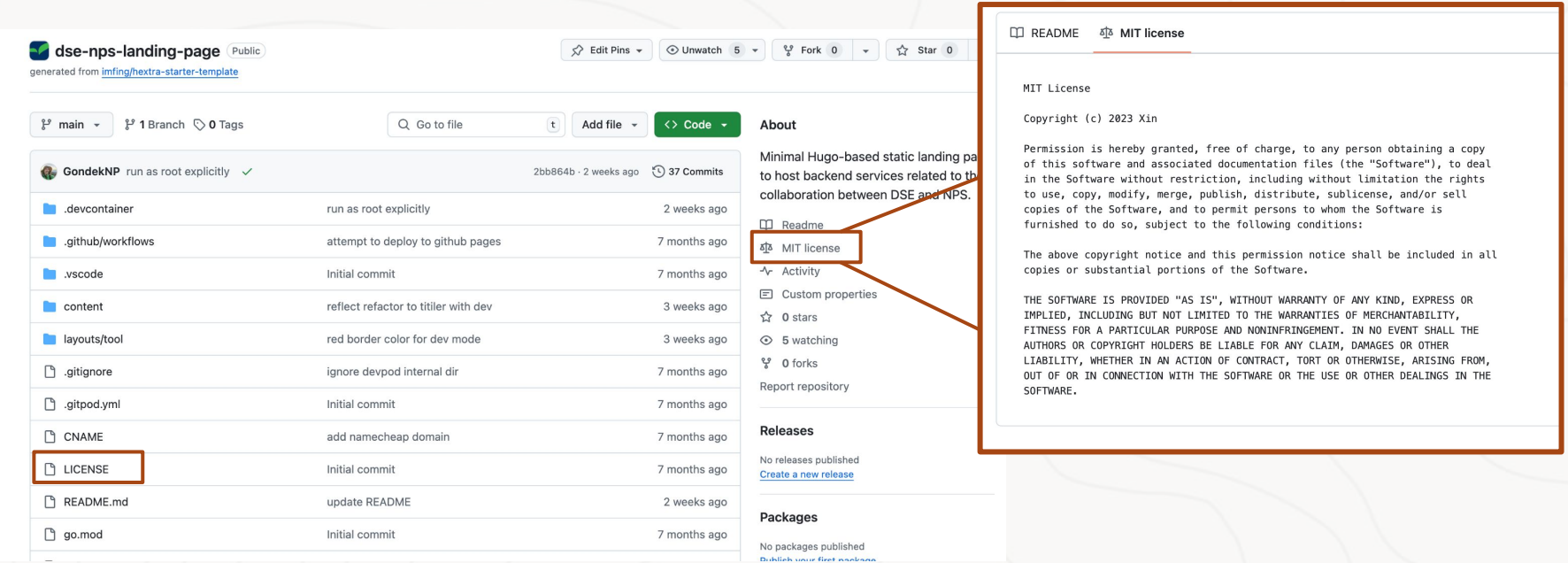
README

- **R**(ecipe)**EADME**.md
  - What the project does
  - Why the project is useful
  - How users can get started with the project
  - Where users can get help with your project
  - Who maintains and contributes to the project
- Also typically includes:
  - License, contribution guidelines, and a code of conduct



Licensing

- What people can or can’t do with your code
  - LICENSE.txt, LICENSE.md



Docstrings

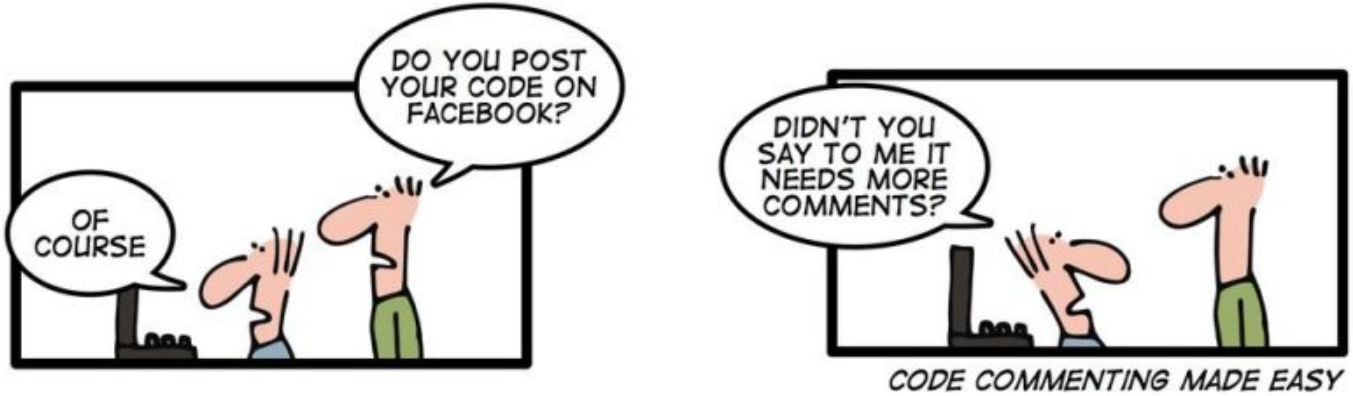
- A string right after defining a function
  - Describes the purpose of the function
  - Defines **parameters** (input) and **returns** (output)
  - Uses three double-quotes: “”” Docstring “”””


```python
def get_date_retrieved(df):
    """
    Input: Dataframe with 'Image Name' column
    Output: Dataframe with 'Date Retrieved' column
    Explanation: This function extracts the date from the 'Image Name' column and stores it in a new column 'Date Retrieved'.
    'Date Retrieved' corresponds to the date that the camera was retrieved from the field.
    """

    df['Date Retrieved'] = df['Image Name'].str.extract(r'\d{8}')
    return df
```

Comments

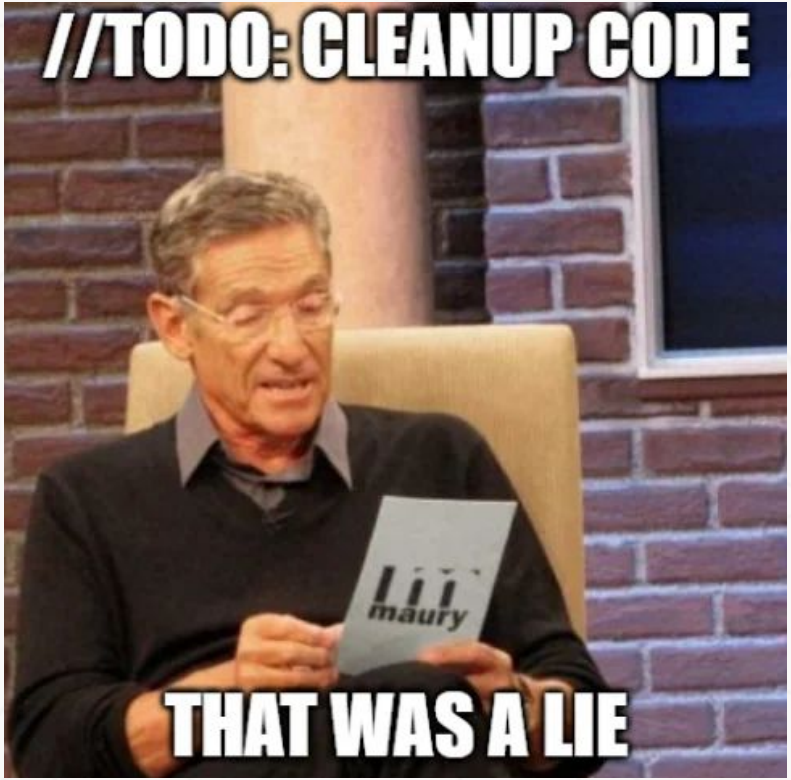
- Annotations throughout source code
  - #Comment, //Comment
  - Mainly used for debugging, modifications, questions, and reminders

```
#  Data Frame: converting non-8-digit dates to date format
def create_df_1(df):
    df_1 = df.copy()
```



TODO and FIXME notes

- TODO: parts of code to work on eventually
  - Adding features, manage progress
- FIXME: reminders of broken code to fix
  - Typically code that is not urgent to fix
- Should **NOT** be present in stable code



Type hinting

- Indicates expected data types for function arguments and return values
  - String, float, integer, boolean, double, dataframe, etc.

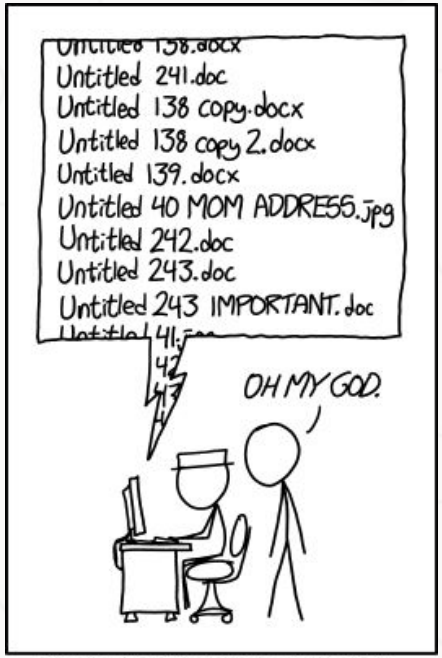
```python
# This is how you annotate a function definition
def stringify(num: int) -> str:
    return str(num)

# And here's how you specify multiple arguments
def plus(num1: int, num2: int) -> int:
    return num1 + num2

# If a function does not return a value, use None as the return type
# Default value for an argument goes after the type annotation
def show(value: str, excitement: int = 10) -> None:
    print(value + "!" * excitement)
```

Naming conventions

- For data: files
- For code: variables, functions, classes
- Best practice: establish beforehand!

👉 Let's take a look at this [excellent worksheet]

- Put it in the README.md!
- Avoid: ecotech_last_draft_final_FINAL.ppt
- Do: use self-explanatory title, include (numerical) versioning (e.g. by date)
- Example: ecotech_20241120_v3.ppt

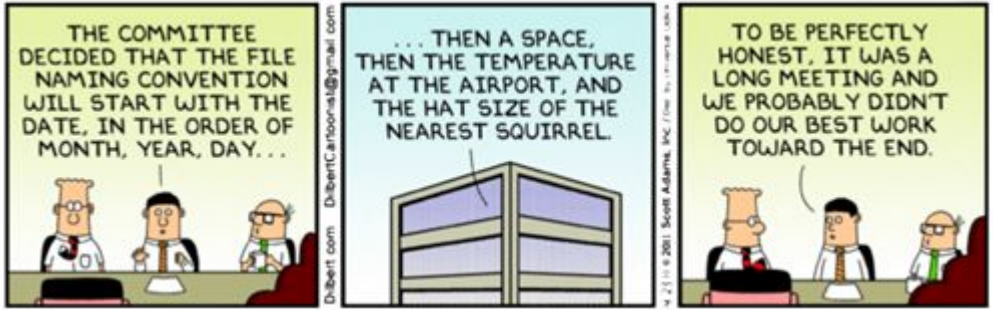


PROTIP: NEVER LOOK IN SOMEONE ELSE'S DOCUMENTS FOLDER.

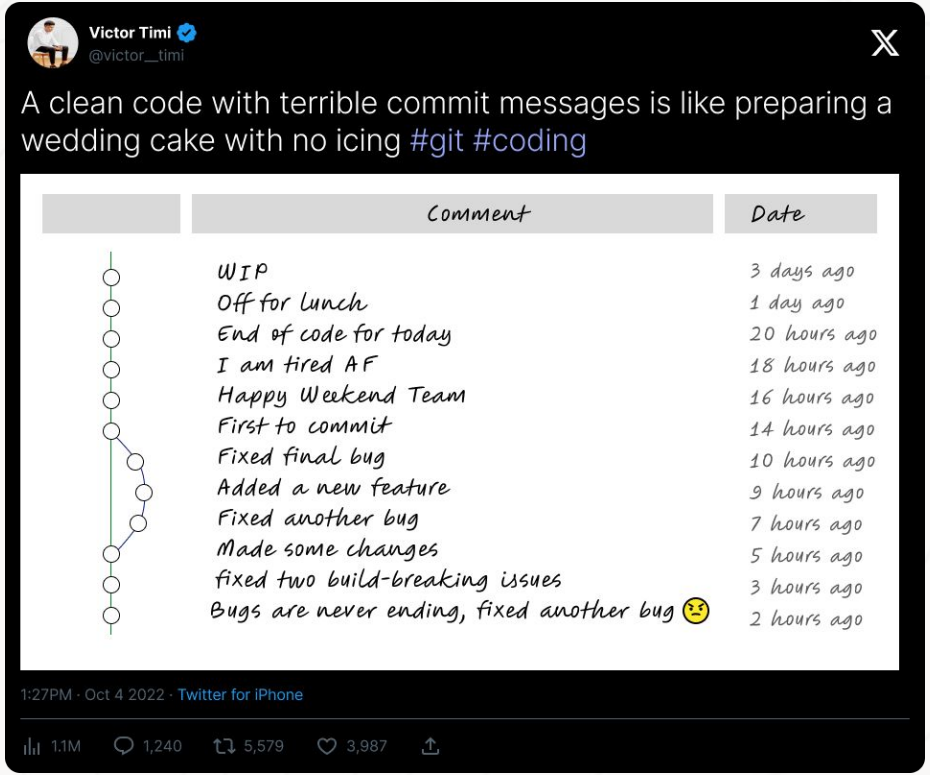
Naming conventions: functions, variables, classes

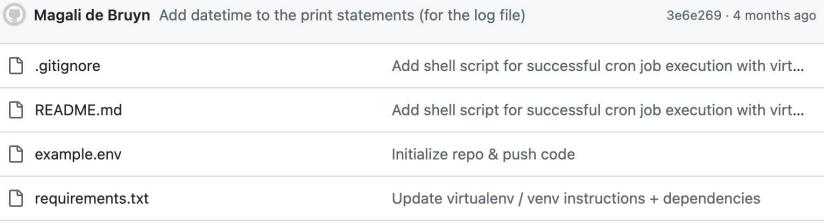
doSomething(folder_path)	vs.	**count_jpg_files**(folder_path)
var1	vs.	**count**
Model	vs.	**Counter**

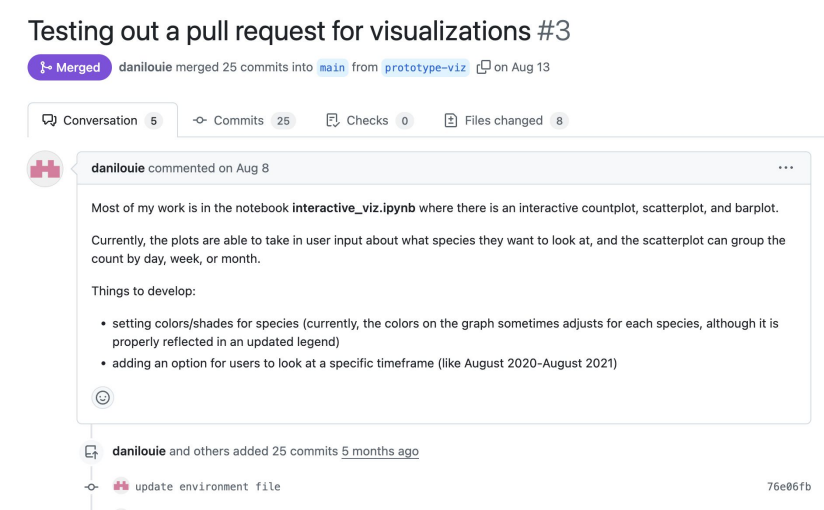
```python
def count_jpg_files(folder_path):
    jpg_count = 0
    for file in os.listdir(folder_path):
        if file.lower().endswith('.jpg'):
            jpg_count += 1
    return jpg_count
```



GitHub versioning: commit messages, PR requests

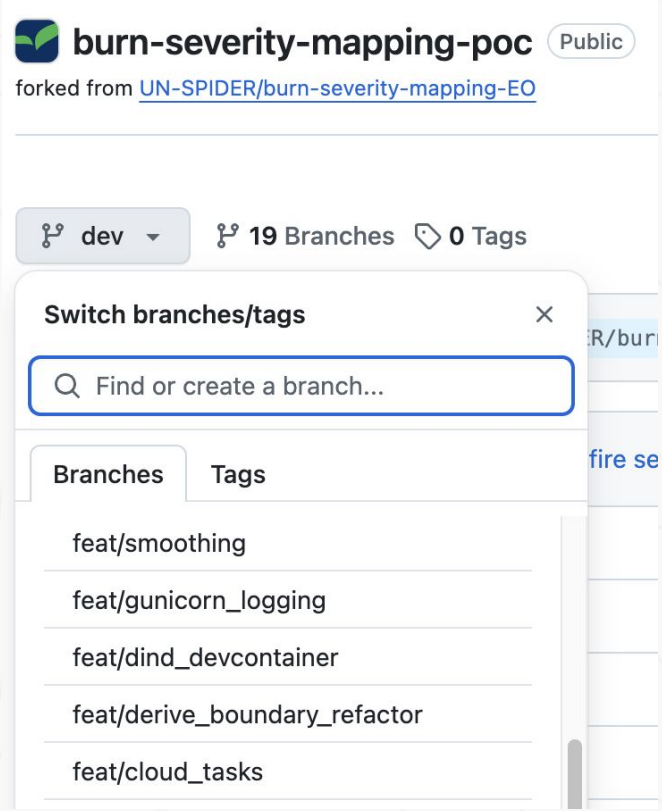






GitHub versioning: branches naming convention

- Preceding category
  - feat/ or feature/
  - bugfix/
  - test/
- Short description
  - feat/smoothing
  - feat/responsive-ux



Configuration files

- YAML, XML, JSON, requirements.txt … environment files
- List external frameworks, libraries, and dependencies

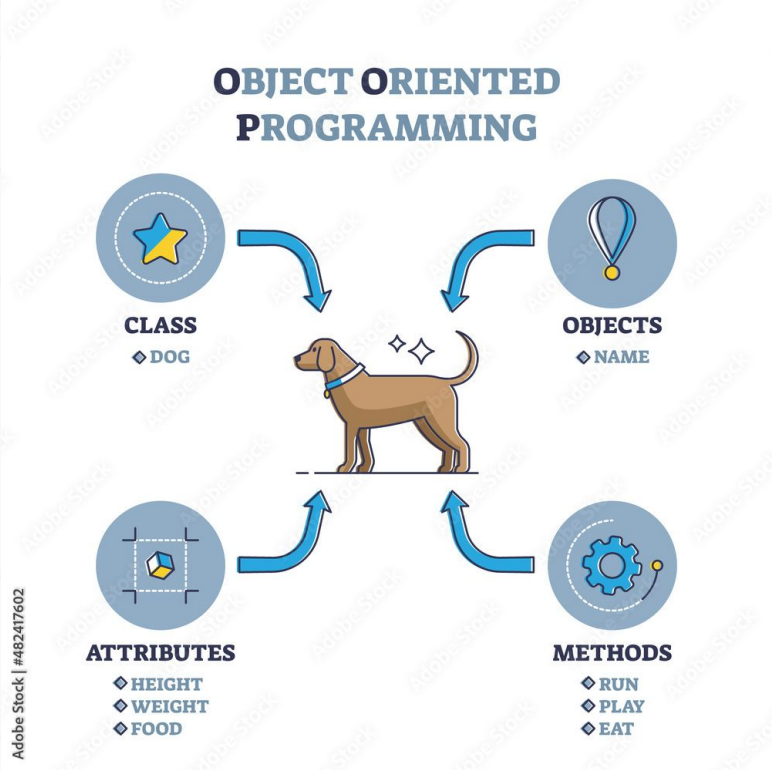

```yaml
name: geoml38
channels:
  - conda-forge
  - apple

dependencies:
  - python=3.8
  - pip
  - ipykernel
  - numpy
  - pandas
  - xarray
  - geopandas
  - jupyterlab
  - geojson
  - affine
  - rasterio
  - scikit-learn
  - earthengine-api
  - matplotlib
  - seaborn
  - tensorflow-deps
  - unidecode
  - geemap
  - pip:
    - radiant_mlhub
    - tensorflow-macos
    - tensorflow-metal
```

This lends itself to object-oriented programming…

Object-oriented programming as a documenting structure

Copy code

```python
class Dog:
    def __init__(self, name, age, breed):
        self.name = name
        self.age = age
        self.breed = breed

    def bark(self):
        print("Woof!")

    def get_name(self):
        return self.name

    def get_age(self):
        return self.age

    def get_breed(self):
        return self.breed

dog1 = Dog("Fido", 3, "Labrador")
dog2 = Dog("Buddy", 5, "Golden Retriever")
```



Exercise time! 🏋️

Can you document this code better?

Clone this repository in our [Github]

```
# minutes
def beep_boop_vrrrr(x):
    if x < 1:
        return "short"
    elif (x >= 11 & x < 3):
        return "medium"
    elif (x >= 3 & x < 5):
        return "long"
```

Answer key: Who's the potato king/queen? 🥔👑

- +1 if you renamed functions
- + 1 if you renamed variables
- + 3 if you added docstrings
  - + 1 if you added an explanation for what the function does
  - + 1 if you added what kind of argument is inputted
  - + 1 if you added what is the result of the function
- + 1 if you deleted unnecessary comments
- + 1 if you added type hinting
- + 10 if you figured out what this class is trying to do
- What else? What might we have missed? +x 😊