

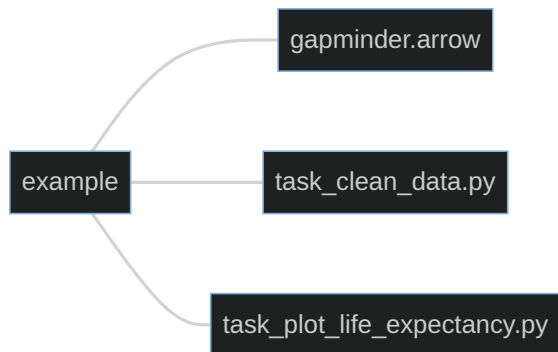
# **Effective Programming Practices for Economists**

## **Reproducible Research**

**What does pytask do?**

Janoś Gabler and Hans-Martin von Gaudecker

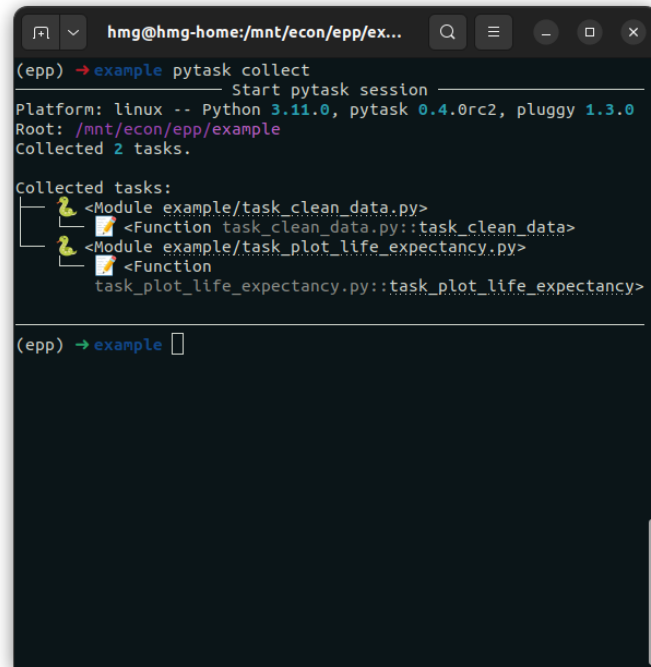
# A tiny example project



- `example/task_clean_data.py`
  - Contains the function `task_clean_data`
  - If called, the function reads in `example/gapminder.arrow` and produces `example/bld/data.pkl`
- `example/task_plot_life_expectancy.py`
  - Contains the function `task_plot_life_expectancy`
  - If called, the function reads in `example/bld/data.pkl` and produces `example/bld/life_expectancy.svg`

# Step 1: collection

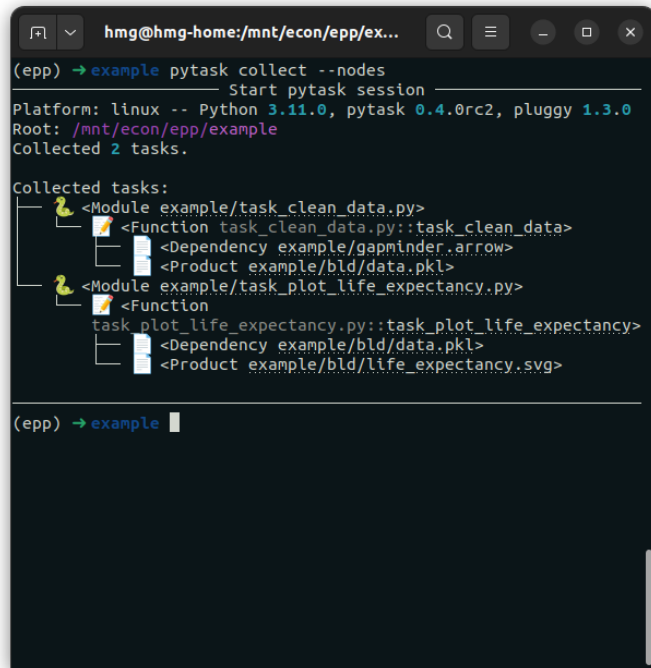
- Go through all folders in working directory
- Collect all files with name `task_XXX.py`
- Go through those files and collect all functions that start with `task_`
- Task functions and their (default) inputs will be used to construct the workflow



```
hmg@hmg-home:/mnt/econ/epp/ex...  
(epp) → example pytask collect  
Start pytask session  
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0  
Root: /mnt/econ/epp/example  
Collected 2 tasks.  
  
Collected tasks:  
└─ <Module example/task_clean_data.py>  
    └─ <Function task_clean_data.py::task_clean_data>  
└─ <Module example/task_plot_life_expectancy.py>  
    └─ <Function task_plot_life_expectancy.py::task_plot_life_expectancy>  
  
(epp) → example
```

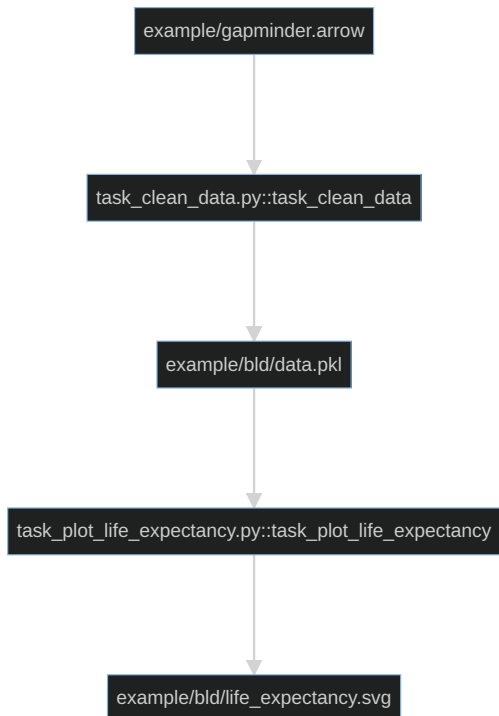
# Step 2: Dependency graph (DAG)

- Inspect function signatures to build a dependency graph
- `produces` describes function output`
- Other arguments are function dependencies
- DAG structure enables to determine an order of execution that respects dependency structure (topological sort)

A terminal window with a dark background and light text. The title bar shows the user 'hmg' at 'hmg-home' in the directory '/mnt/econ/epp/ex...'. The prompt is '(epp)'. The user has entered 'example pytask collect --nodes'. The output shows 'Start pytask session' followed by platform and root information. It then lists 'Collected 2 tasks.' and shows a tree structure of tasks. The first task is a module 'example/task\_clean\_data.py' containing a function 'task\_clean\_data' which has a dependency on 'example/gapminder.arrow' and produces 'example/bld/data.pkl'. The second task is a module 'example/task\_plot\_life\_expectancy.py' containing a function 'task\_plot\_life\_expectancy' which has a dependency on 'example/bld/data.pkl' and produces 'example/bld/life\_expectancy.svg'. The prompt is now '(epp) → example'.

```
hmg@hmg-home:/mnt/econ/epp/ex...  
(epp) → example pytask collect --nodes  
Start pytask session  
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0  
Root: /mnt/econ/epp/example  
Collected 2 tasks.  
  
Collected tasks:  
└─ <Module example/task_clean_data.py>  
    └─ <Function task_clean_data.py::task_clean_data>  
        └─ <Dependency example/gapminder.arrow>  
            └─ <Product example/bld/data.pkl>  
└─ <Module example/task_plot_life_expectancy.py>  
    └─ <Function task_plot_life_expectancy.py::task_plot_life_expectancy>  
        └─ <Dependency example/bld/data.pkl>  
            └─ <Product example/bld/life_expectancy.svg>  
  
(epp) → example
```

# Can you see the DAG?

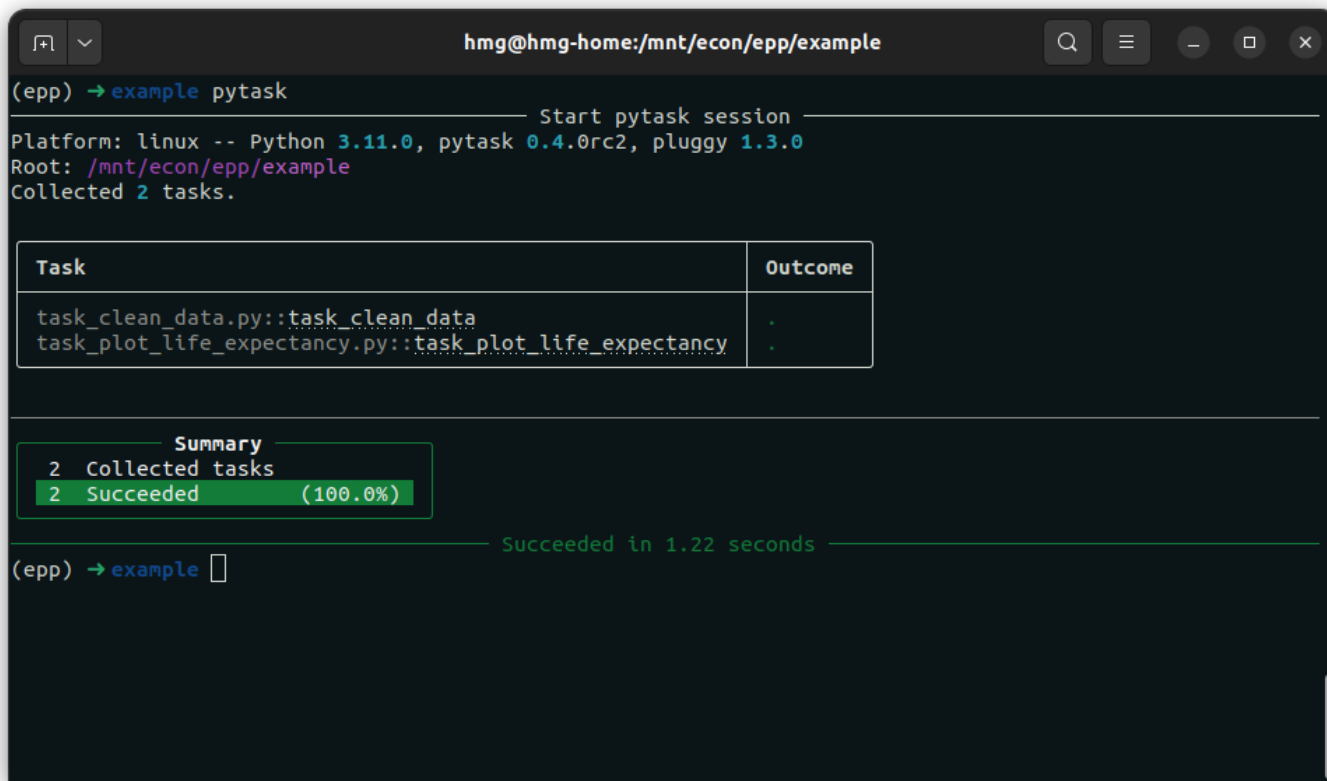


```
hmg@hmg-home:/mnt/econ/epp/ex...  
(epp) → example pytask collect --nodes  
Start pytask session  
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0  
Root: /mnt/econ/epp/example  
Collected 2 tasks.  
  
Collected tasks:  
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│   └─ <Function task_clean_data.py::task_clean_data>  
│       └─ <Dependency example/gapminder.arrow>  
│           └─ <Product example/bld/data.pkl>  
└─ <Module example/task_plot_life_expectancy.py>  
    └─ <Function task_plot_life_expectancy.py::task_plot_life_expectancy>  
        └─ <Dependency example/bld/data.pkl>  
            └─ <Product example/bld/life_expectancy.svg>  
  
(epp) → example
```

## Step 3: Track changes and execute

- Pytask knows which files should need to be generated
- Also keeps track on when code or products have changed
- Functions are only run if:
  - They have changed
  - A dependency has changed
- Huge time savings in large empirical projects!

# Run for the first time



A terminal window titled 'hmg@hmg-home:/mnt/econ/epp/example' showing the execution of the 'example' task. The prompt is '(epp) → example pytask'. The output indicates a successful start of a pytask session on a Linux platform with Python 3.11.0, pytask 0.4.0rc2, and pluggy 1.3.0. It shows that 2 tasks were collected and both succeeded. A summary box highlights '2 Collected tasks' and '2 Succeeded (100.0%)'. The session concluded with the message 'Succeeded in 1.22 seconds'.

```
(epp) → example pytask
----- Start pytask session -----
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0
Root: /mnt/econ/epp/example
Collected 2 tasks.
```

Task	Outcome
task_clean_data.py::task_clean_data	✓
task_plot_life_expectancy.py::task_plot_life_expectancy	✓

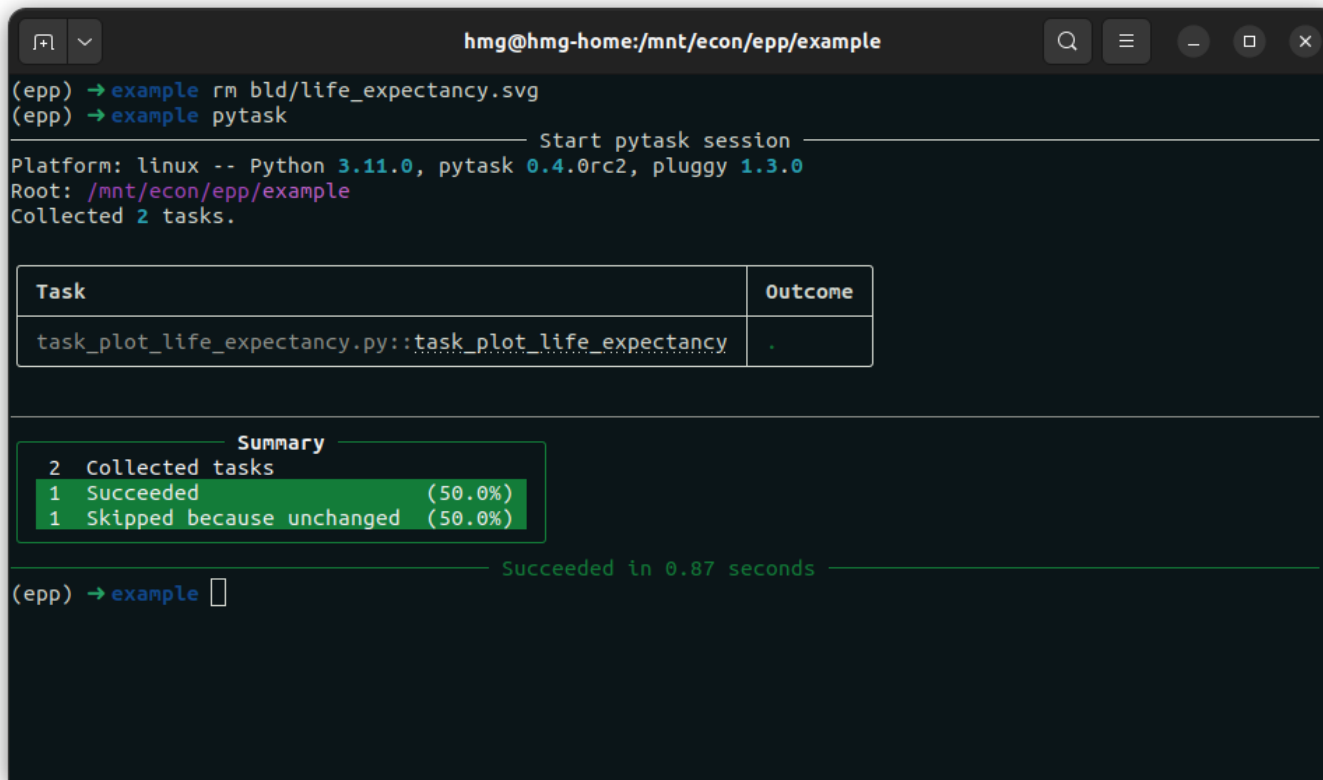
**Summary**

2 Collected tasks

2 Succeeded (100.0%)

```
----- Succeeded in 1.22 seconds -----
(epp) → example
```

# Delete plot and run again



```
hmg@hmg-home:/mnt/econ/epp/example
(epp) → example rm bld/life_expectancy.svg
(epp) → example pytask

----- Start pytask session -----
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0
Root: /mnt/econ/epp/example
Collected 2 tasks.



| Task                                                    | Outcome |
|---------------------------------------------------------|---------|
| task_plot_life_expectancy.py::task_plot_life_expectancy | .       |

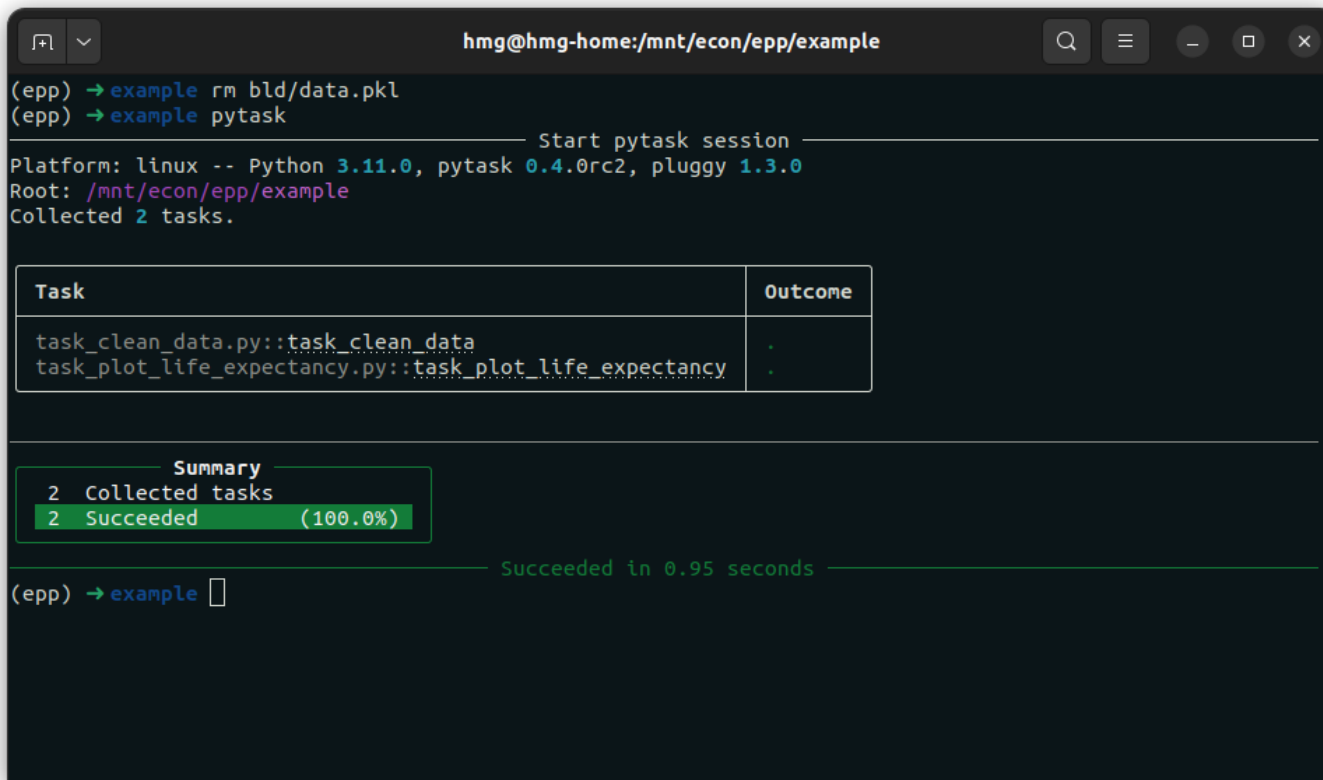


----- Summary -----
2 Collected tasks
1 Succeeded (50.0%)
1 Skipped because unchanged (50.0%)

----- Succeeded in 0.87 seconds -----
(epp) → example
```



# Delete cleaned data and run again



```
hmg@hmg-home:/mnt/econ/epp/example
(epp) → example rm bld/data.pkl
(epp) → example pytask

----- Start pytask session -----
Platform: linux -- Python 3.11.0, pytask 0.4.0rc2, pluggy 1.3.0
Root: /mnt/econ/epp/example
Collected 2 tasks.



| Task                                                    | Outcome |
|---------------------------------------------------------|---------|
| task_clean_data.py::task_clean_data                     | .       |
| task_plot_life_expectancy.py::task_plot_life_expectancy | .       |



----- Summary -----
2 Collected tasks
2 Succeeded (100.0%)

----- Succeeded in 0.95 seconds -----
(epp) → example
```