

# How to organize a growing set of tests?

UNIT TESTING FOR DATA SCIENCE IN PYTHON



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Test Automation Engineer

# What you've done so far

16

- `row_to_list()`
- `convert_to_int()`
- `get_data_as_numpy_array()`
- `split_into_training_and_testing_sets()`

# What you've done so far

32

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- ...

# What you've done so far

64

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- `...`

# What you've done so far

128

- `row_to_list()`
- `convert_to_int()`
- `get_data_as_numpy_array()`
- `split_into_training_and_testing_sets()`
- `...`

# Need a strategy to organize tests

128

# Need a strategy to organize tests



# Project structure

```
src/
```

```
# All application code lives here
```



# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
    |-- __init__.py
```

# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
    |-- __init__.py
    |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
```

# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
    |-- __init__.py
```

# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
    |-- __init__.py
    |-- as_numpy.py                # Contains get_data_as_numpy_array()
```

# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                         # Package for training and testing linear regression model
    |-- __init__.py
```

# Project structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                         # Package for training/testing linear regression model
|   |-- __init__.py
|   |-- train.py                   # Contains split_into_training_and_testing_sets()
```

# The tests folder

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                        # Package for training/testing linear regression model
|   |-- __init__.py
|   |-- train.py                  # Contains split_into_training_and_testing_sets()
tests/                             # Test suite: all tests live here
```

# The tests folder mirrors the application folder

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                        # Package for training/testing linear regression model
|   |-- __init__.py
|   |-- train.py                   # Contains split_into_training_and_testing_sets()
tests/                              # Test suite: all tests live here
|-- data/
|   |-- __init__.py
|-- features/
|   |-- __init__.py
|-- models/
    |-- __init__.py
```



# Python module and test module correspondence

- `my_module.py`  $\iff$  `test_my_module.py` .

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                         # Package for training/testing linear regression model
|   |-- __init__.py
|   |-- train.py                   # Contains split_into_training_and_testing_sets()
tests/                              # Test suite: all tests live here
|-- data/
|   |-- __init__.py
|   |-- test_preprocessing_helpers.py # Corresponds to module src/data/preprocessing_helpers.py
|-- features/
|   |-- __init__.py
|-- models/
    |-- __init__.py
```

# Structuring tests inside test modules

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

def test_on_no_tab_no_missing_value():    # A test for row_to_list()
    ...

def test_on_two_tabs_no_missing_value():  # Another test for row_to_list()
    ...

...

def test_with_no_comma():                 # A test for convert_to_int()
    ...

def test_with_one_comma():                # Another test for convert_to_int()
    ...

...
```

# Test class

# Test class is a container for a single unit's tests



# Test class: theoretical structure

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

class
```

# Test class: theoretical structure

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

class TestRowToList():                                # Use CamelCase
```

# Test class: theoretical structure

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

class TestRowToList(object):
    # Always put the argument object
    def test_on_no_tab_no_missing_value():
        # A test for row_to_list()
        ...

    def test_on_two_tabs_no_missing_value():
        # Another test for row_to_list()
        ...
```

# Test class: theoretical structure

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

class TestRowToList(object):          # Always put the argument object
    def test_on_no_tab_no_missing_value(self):  # Always put the argument self
        ...

    def test_on_two_tabs_no_missing_value(self): # Always put the argument self
        ...
```



# Clean separation

- Test module: `test_preprocessing_helpers.py`

```
import pytest
from data.preprocessing_helpers import row_to_list, convert_to_int

class TestRowToList(object):          # Always put the argument object
    def test_on_no_tab_no_missing_value(self):  # Always put the argument self
        ...

    def test_on_two_tabs_no_missing_value(self): # Always put the argument self
        ...

class TestConvertToInt(object):       # Test class for convert_to_int()
    def test_with_no_comma(self):      # A test for convert_to_int()
        ...

    def test_with_one_comma(self):     # Another test for convert_to_int()
        ...
```

# Final test directory structure

```
src/                                # All application code lives here
|-- data/                           # Package for data preprocessing
|   |-- __init__.py
|   |-- preprocessing_helpers.py    # Contains row_to_list(), convert_to_int()
|-- features/                       # Package for feature generation from preprocessed data
|   |-- __init__.py
|   |-- as_numpy.py                # Contains get_data_as_numpy_array()
|-- models/                         # Package for training/testing linear regression model
|   |-- __init__.py
|   |-- train.py                   # Contains split_into_training_and_testing_sets()
tests/                              # Test suite: all tests live here
|-- data/
|   |-- __init__.py
|   |-- test_preprocessing_helpers.py # Contains TestRowToList, TestConvertToInt
|-- features/
|   |-- __init__.py
|   |-- test_as_numpy.py           # Contains TestGetDataAsNumpyArray
|-- models/
|   |-- __init__.py
|   |-- test_train.py              # Contains TestSplitIntoTrainingAndTestingSets
```

# Test directory is well organized!



# IPython console's working directory is tests

The screenshot shows the DataCamp interface for an exercise. On the left, there's a sidebar with 'Exercise' and 'Instructions 2/2' (50 XP). The main area displays a code editor for 'script.py' with line numbers 1 through 8. Below the editor is an 'IPython Shell' window. The shell shows 'In [1]:' followed by a blank line, indicating the current working directory is 'tests'.

DataCamp

Course Outline

Exercise

Instructions 2/2 50 XP

script.py

1  
2  
3  
4  
5  
6  
7  
8

Run Code

IPython Shell

In [1]:

# IPython console's working directory is tests

```
src/
|-- data/
|   |-- __init__.py
|   |-- preprocessing_helpers.py
|-- features/
|   |-- __init__.py
|   |-- as_numpy.py
|-- models/
|   |-- __init__.py
|   |-- train.py
tests/                                # This is IPython console's working directory from now on
|-- data/
|   |-- __init__.py
|   |-- test_preprocessing_helpers.py
|-- features/
|   |-- __init__.py
|   |-- test_as_numpy.py
|-- models/
    |-- __init__.py
    |-- test_train.py
```

# Let's practice structuring tests!

UNIT TESTING FOR DATA SCIENCE IN PYTHON

# Mastering test execution

UNIT TESTING FOR DATA SCIENCE IN PYTHON



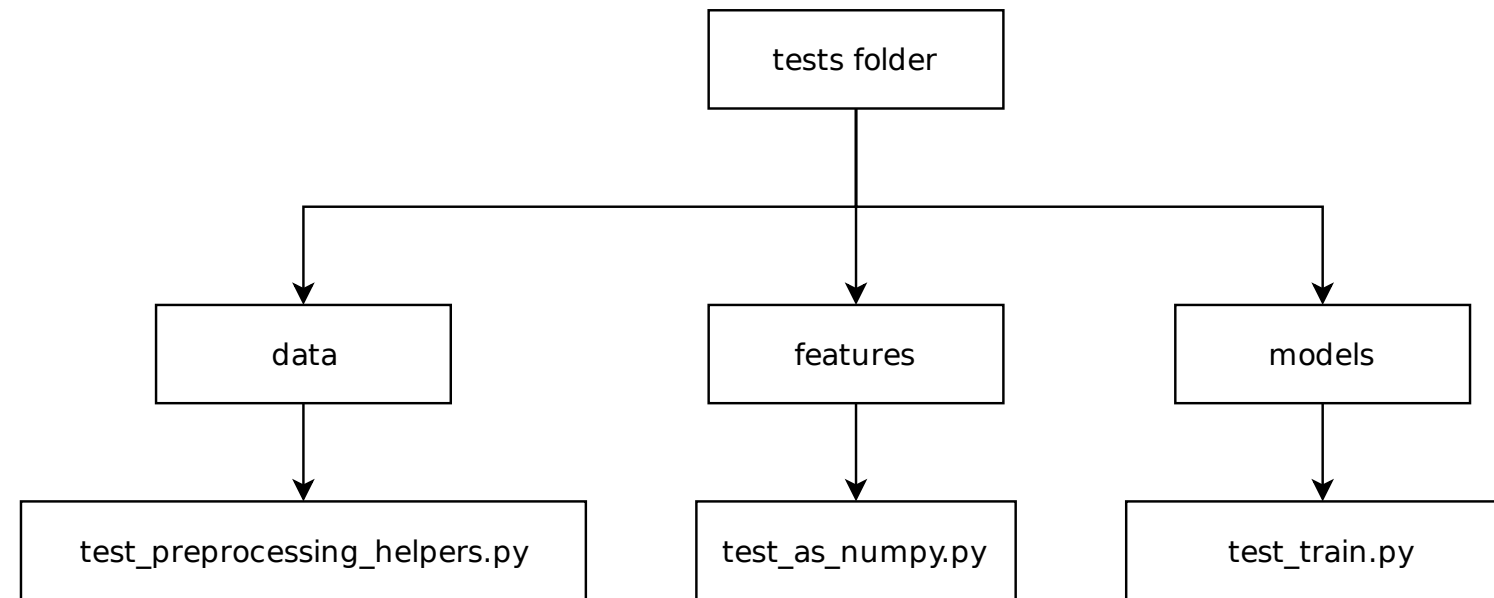
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# Test organization

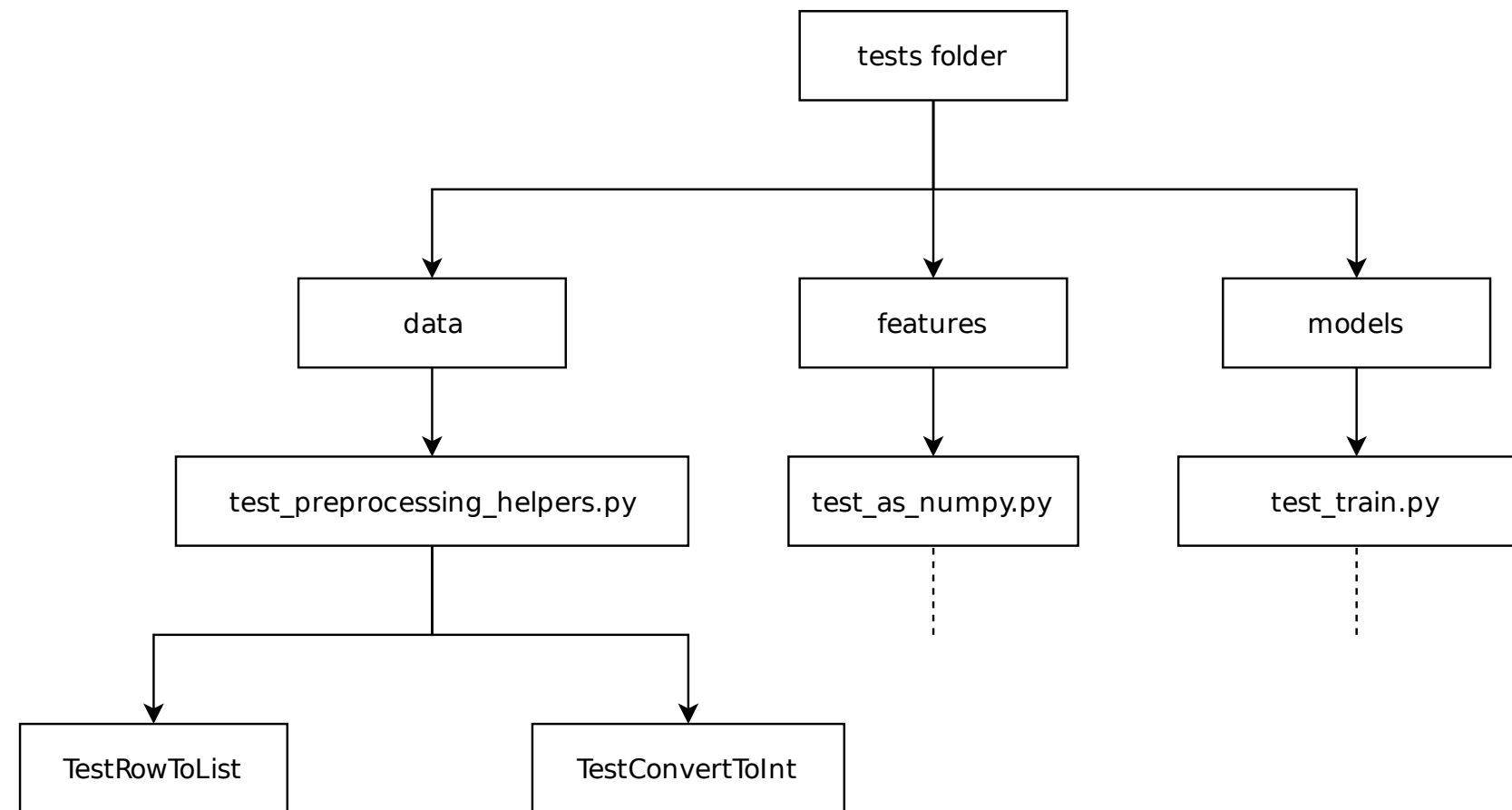
tests folder



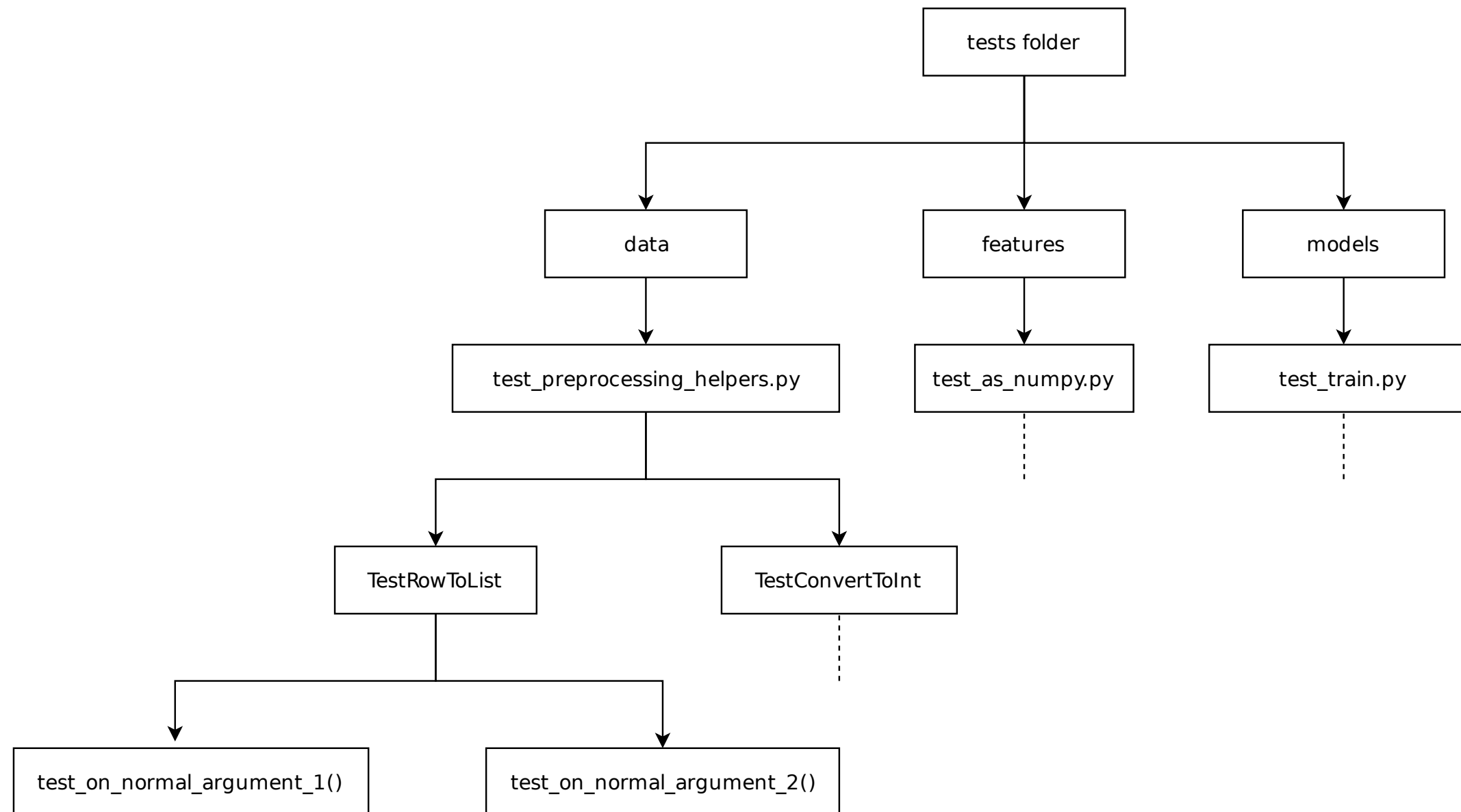
# Test organization



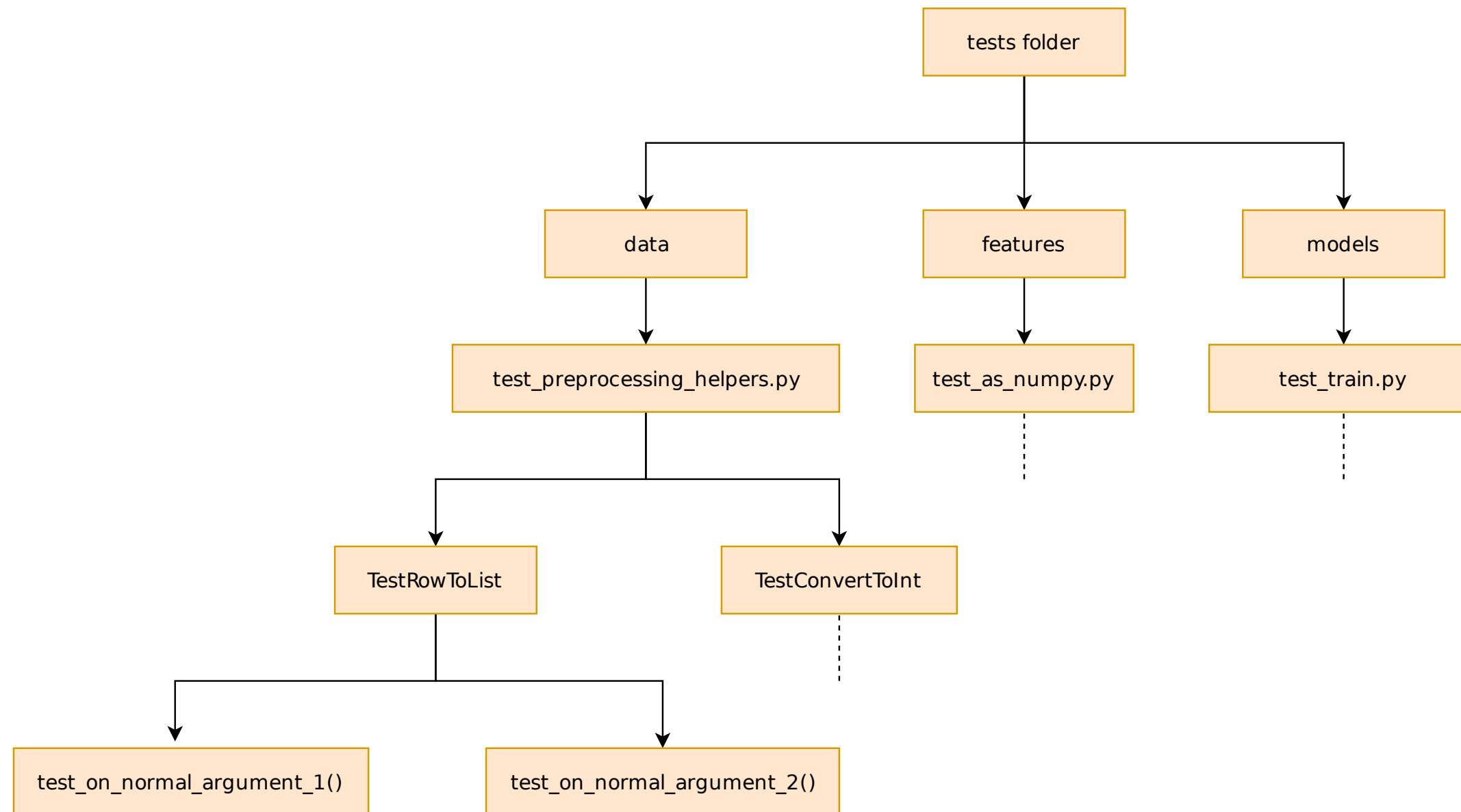
# Test organization



# Test organization



# Running all tests



# Running all tests

```
cd tests
pytest
```

- Recurses into directory subtree of `tests/`.
  - Filenames starting with `test_` → test module.
    - Classnames starting with `Test` → test class.
      - Function names starting with `test_` → unit test.

# Running all tests

```
===== test session starts =====
data/test_preprocessing_helpers.py .....F.... [ 81%]
features/test_as_numpy.py . [ 87%]
models/test_train.py .. [100%]

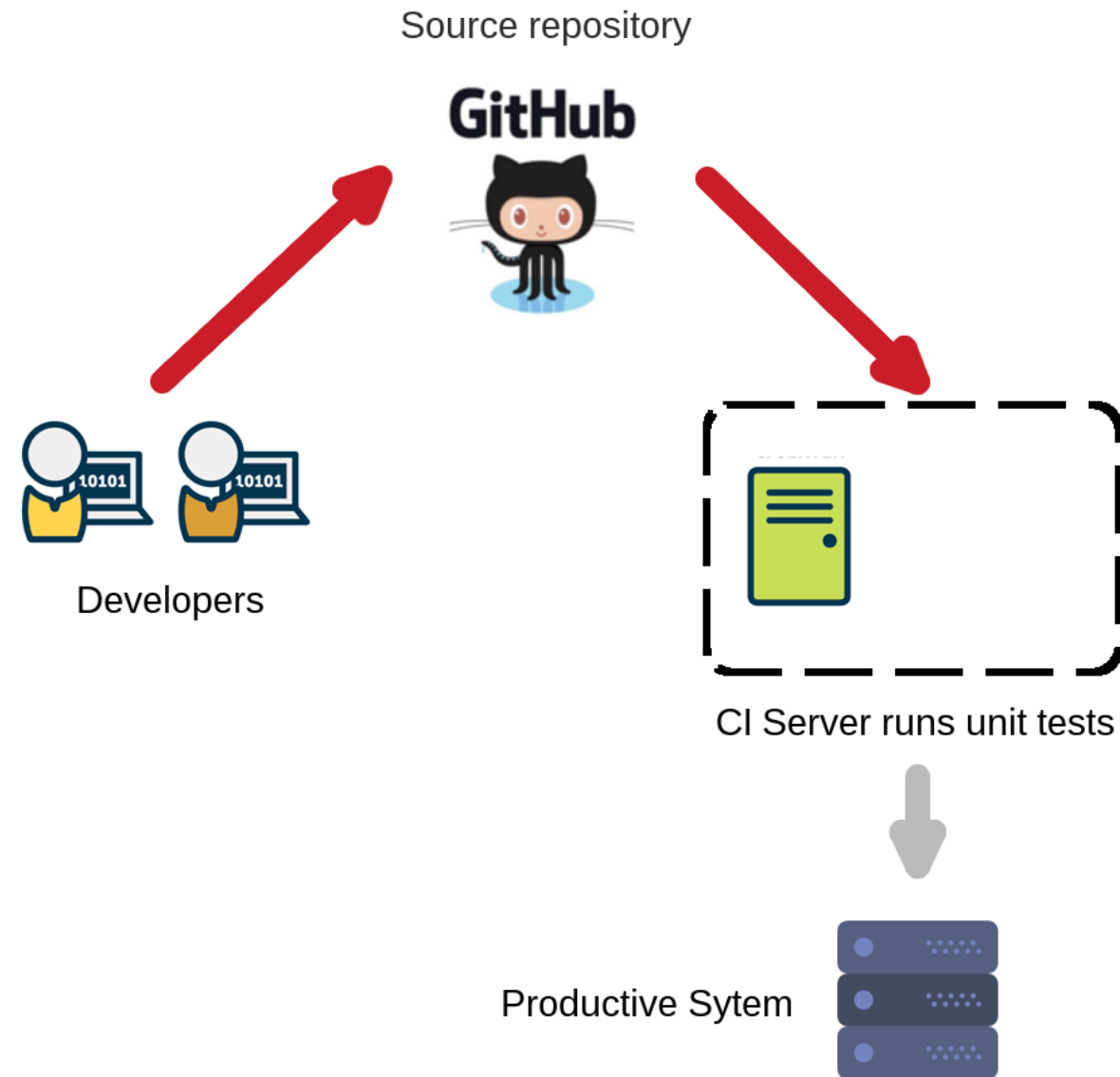
===== FAILURES =====
----- TestRowToList.test_on_one_tab_with_missing_value -----

self = <tests.data.test_preprocessing_helpers.TestRowToList object at 0x7f6205475240>

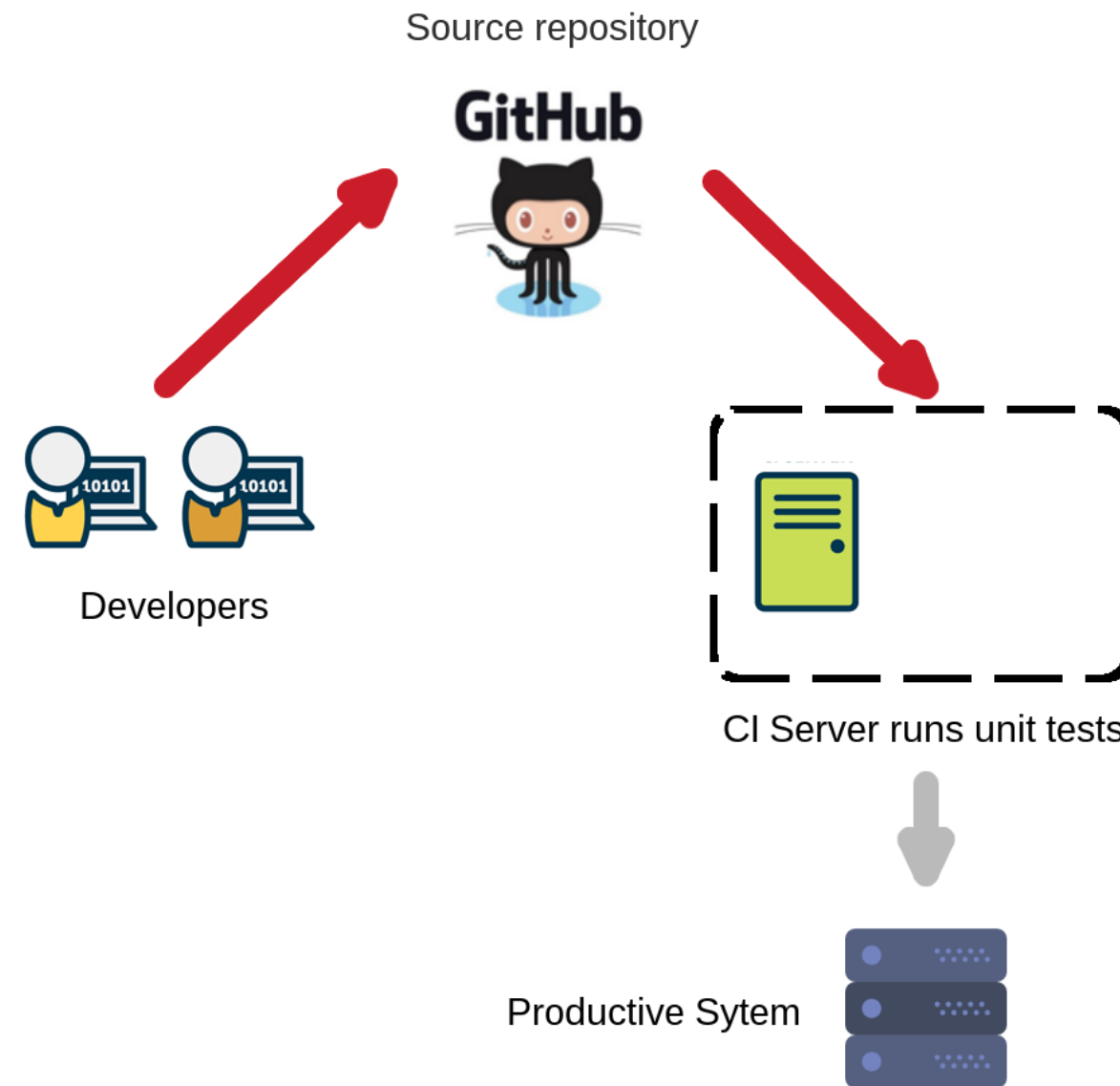
    def test_on_one_tab_with_missing_value(self): # (1, 1) boundary value
        actual = row_to_list("\t4,567\n")
>       assert actual is None, "Expected: None, Actual: {0}".format(actual)
E       AssertionError: Expected: None, Actual: ['', '4,567']
E       assert ['', '4,567'] is None

data/test_preprocessing_helpers.py:55: AssertionError
===== 1 failed, 15 passed in 0.46 seconds =====
```

# Typical scenario: CI server



# Binary question: do all unit tests pass?





# The -x flag: stop after first failure

```
pytest -x
```

```
===== test session starts =====
data/test_preprocessing_helpers.py .....F

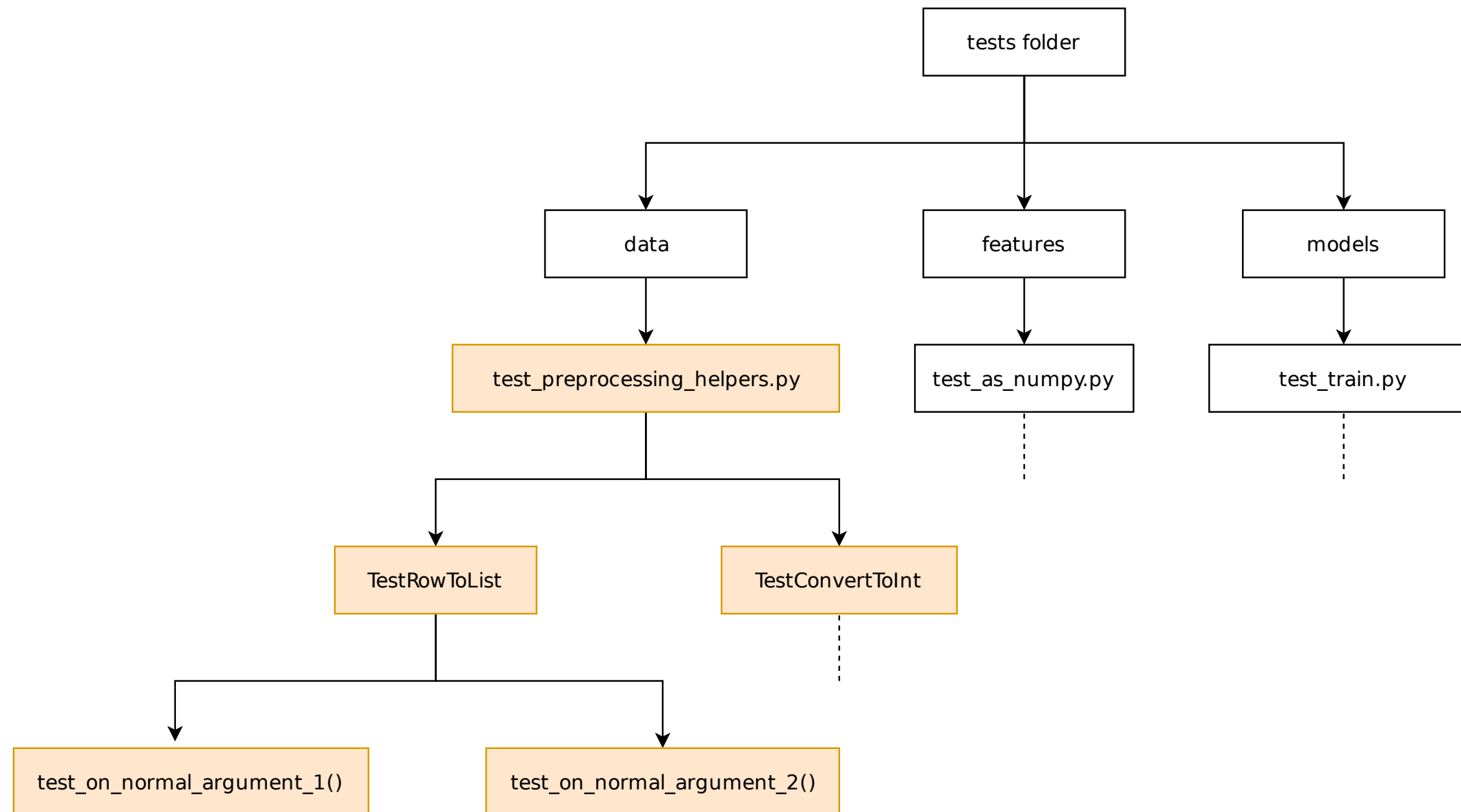
===== FAILURES =====
----- TestRowToList.test_on_one_tab_with_missing_value -----

self = <tests.data.test_preprocessing_helpers.TestRowToList object at 0x7f6309f17198>

    def test_on_one_tab_with_missing_value(self):    # (1, 1) boundary value
        actual = row_to_list("\t4,567\n")
>       assert actual is None, "Expected: None, Actual: {0}".format(actual)
E       AssertionError: Expected: None, Actual: ['', '4,567']
E       assert ['', '4,567'] is None

data/test_preprocessing_helpers.py:55: AssertionError
===== 1 failed, 8 passed in 0.45 seconds =====
```

# Running tests in a test module



# Running tests in a test module

```
pytest data/test_preprocessing_helpers.py
```

```
data/test_preprocessing_helpers.py .....F.... [100%]

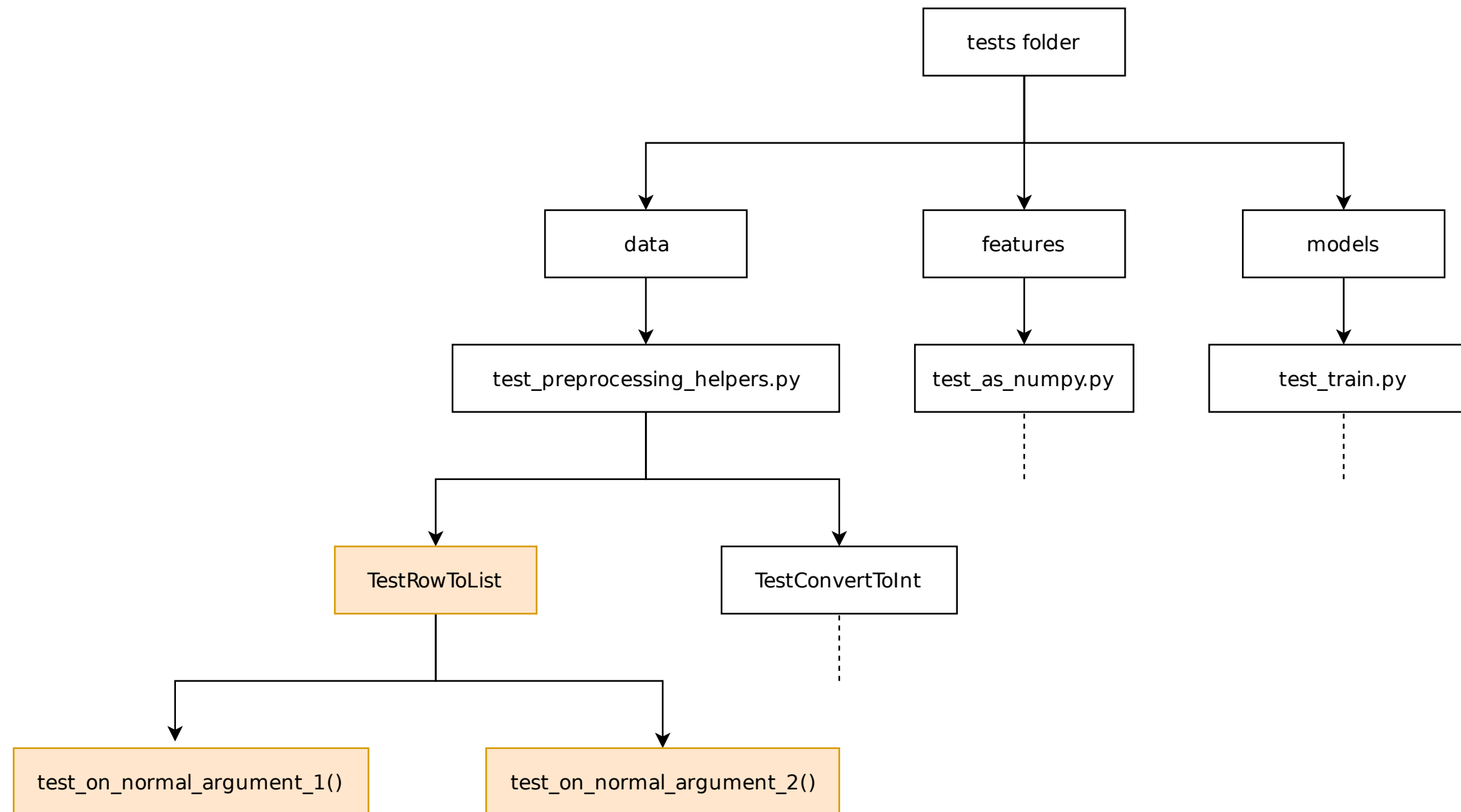
===== FAILURES =====
----- TestRowToList.test_on_one_tab_with_missing_value -----

self = <tests.data.test_preprocessing_helpers.TestRowToList object at 0x7f435947f198>

    def test_on_one_tab_with_missing_value(self):    # (1, 1) boundary value
        actual = row_to_list("\t4,567\n")
>       assert actual is None, "Expected: None, Actual: {}".format(actual)
E       AssertionError: Expected: None, Actual: ['', '4,567']
E       assert ['', '4,567'] is None

data/test_preprocessing_helpers.py:55: AssertionError
===== 1 failed, 12 passed in 0.07 seconds =====
```

# Running only a particular test class



# Node ID

- Node ID of a test class: `<path to test module>::<test class name>`
- Node ID of an unit test: `<path to test module>::<test class name>::<unit test name>`

# Running tests using node ID

- Run the test class `TestRowToList` .

```
pytest data/test_preprocessing_helpers.py::TestRowToList
```

```
data/test_preprocessing_helpers.py ..F.... [100%]

===== FAILURES =====
----- TestRowToList.test_on_one_tab_with_missing_value -----

self = <tests.data.test_preprocessing_helpers.TestRowToList object at 0x7ffb3bac4da0>

    def test_on_one_tab_with_missing_value(self):    # (1, 1) boundary value
        actual = row_to_list("\t4,567\n")
>       assert actual is None, "Expected: None, Actual: {0}".format(actual)
E       AssertionError: Expected: None, Actual: ['', '4,567']
E       assert ['', '4,567'] is None

data/test_preprocessing_helpers.py:55: AssertionError
===== 1 failed, 6 passed in 0.06 seconds =====
```

# Running tests using node ID

- Run the unit test `test_on_one_tab_with_missing_value()` .

```
pytest data/test_preprocessing_helpers.py::TestRowToList::test_on_one_tab_with_missing_value
```

```
data/test_preprocessing_helpers.py F [100%]

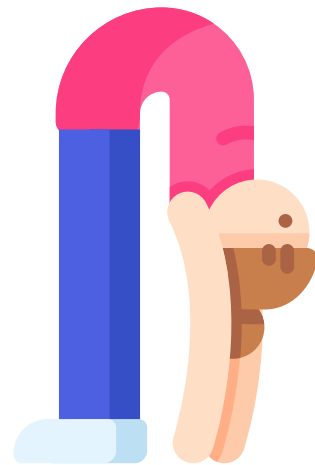
===== FAILURES =====
----- TestRowToList.test_on_one_tab_with_missing_value -----

self = <tests.data.test_preprocessing_helpers.TestRowToList object at 0x7f4eece33b00>

    def test_on_one_tab_with_missing_value(self):    # (1, 1) boundary value
        actual = row_to_list("\t4,567\n")
>       assert actual is None, "Expected: None, Actual: {0}".format(actual)
E       AssertionError: Expected: None, Actual: ['', '4,567']
E       assert ['', '4,567'] is None

data/test_preprocessing_helpers.py:55: AssertionError
===== 1 failed in 0.06 seconds =====
```

# Running tests using keyword expressions





# The -k option

```
pytest -k "pattern"
```

- Runs all tests whose node ID matches the pattern.

# The -k option

- Run the test class `TestSplitIntoTrainingAndTestingSets` .

```
pytest -k "TestSplitIntoTrainingAndTestingSets"
```

```
models/test_train.py .. [100%]

===== 2 passed, 14 deselected in 0.36 seconds =====
```

```
pytest -k "TestSplit"
```

```
models/test_train.py .. [100%]

===== 2 passed, 14 deselected in 0.36 seconds =====
```

# Supports Python logical operators

```
pytest -k "TestSplit and not test_on_one_row"
```

```
models/test_train.py . [100%]
```

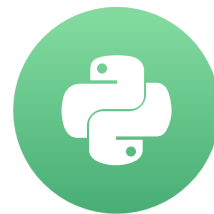
```
===== 1 passed, 15 deselected in 0.36 seconds =====
```

# Let's run some tests!

UNIT TESTING FOR DATA SCIENCE IN PYTHON

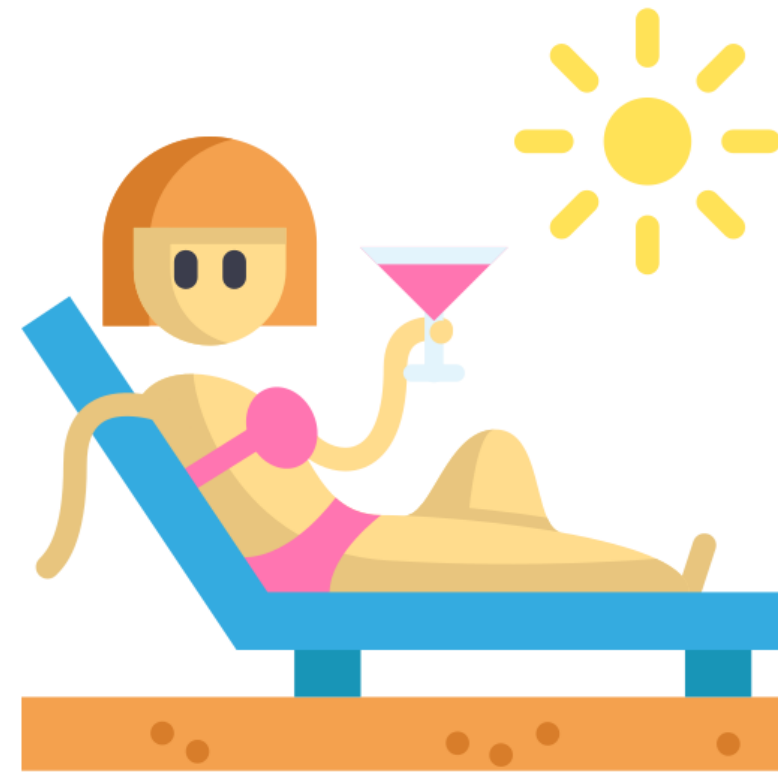
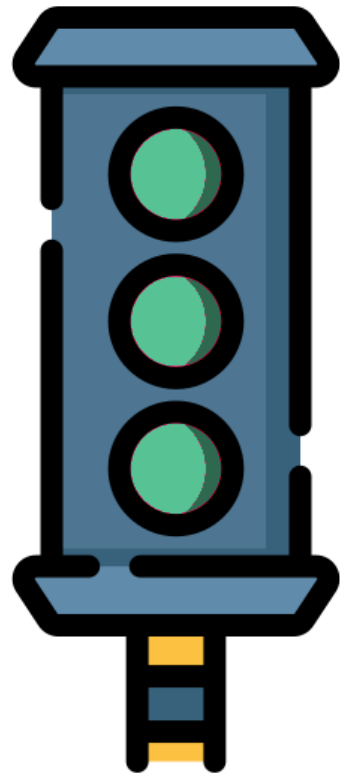
# Expected failures and conditional skipping

UNIT TESTING FOR DATA SCIENCE IN PYTHON

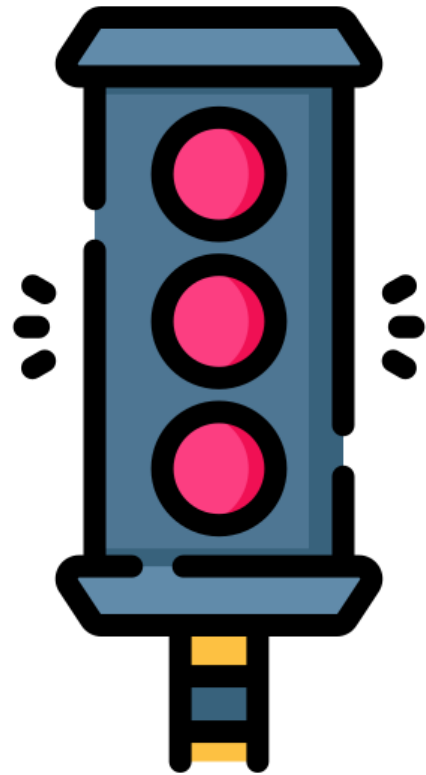


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Test Automation Engineer

# Test suite is green when all tests pass



# Test suite is red when any test fails



# Implementing a function using TDD

- `train_model()` : Returns best fit line given training data.

```
import pytest

class TestTrainModel(object):
    def test_on_linear_data(self):
        ...
```



# The test fails, of course!

pytest

```
===== test session starts =====
data/test_preprocessing_helpers.py ..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..F [100%]

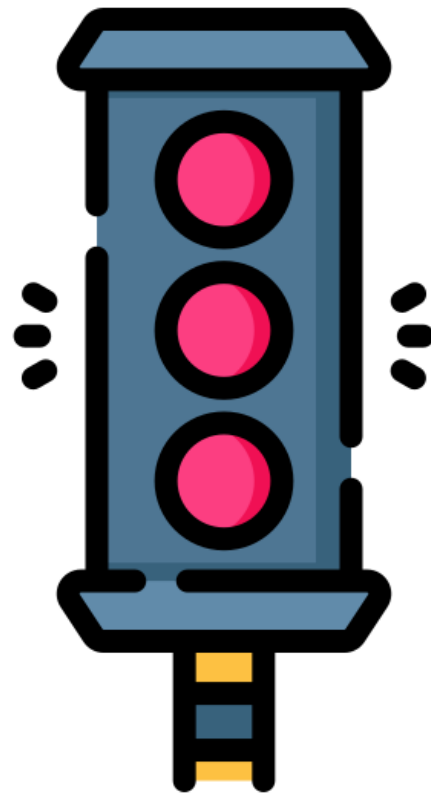
===== FAILURES =====
----- TestTrainModel.test_on_linear_data -----

self = <tests.models.test_train.TestTrainModel object at 0x7f5fc0f31978>

    def test_on_linear_data(self):
        test_input = np.array([[1.0, 3.0], [2.0, 5.0], [3.0, 7.0]])
        expected_slope = 2.0
        expected_intercept = 1.0
>         actual_slope, actual_intercept = train_model(test_input)
E         NameError: name 'train_model' is not defined

models/test_train.py:39: NameError
===== 1 failed, 16 passed in 0.22 seconds =====
```

# False alarm



# xfail: marking tests as "expected to fail"

```
import pytest

class TestTrainModel(object):
    @
    def test_on_linear_data(self):
        ...
```

# xfail: marking tests as "expected to fail"

```
import pytest

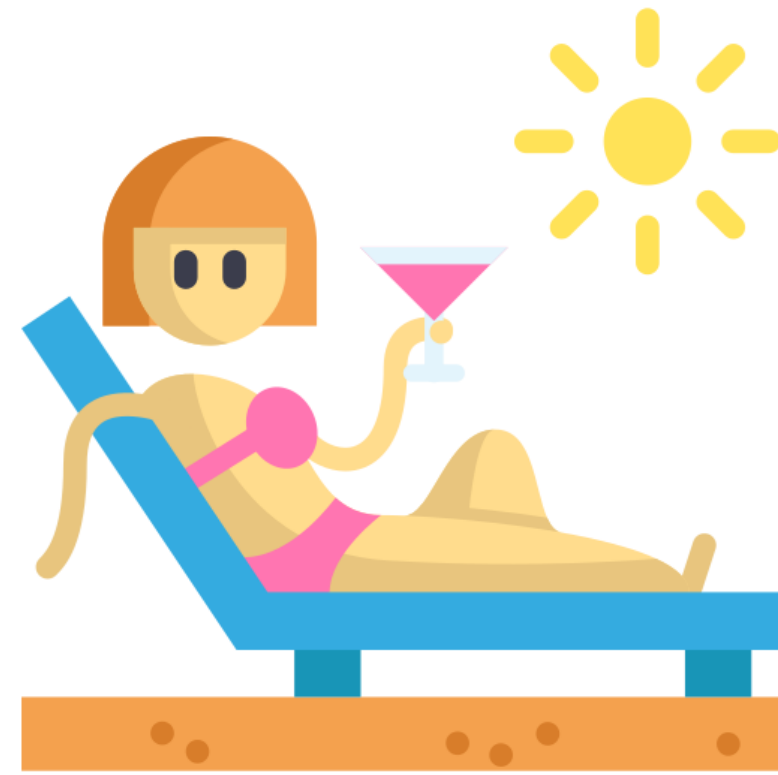
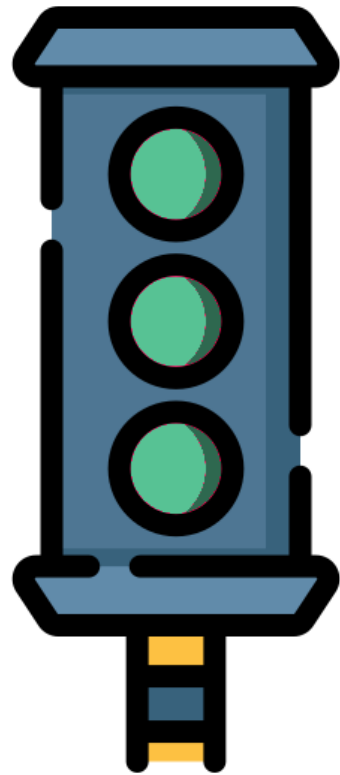
class TestTrainModel(object):
    @pytest.mark.xfail
    def test_on_linear_data(self):
        ...
```

```
pytest
```

```
===== test session starts =====
data/test_preprocessing_helpers.py ..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..x [100%]

===== 16 passed, 1 xfailed in 0.21 seconds =====
```

# Test suite stays green



# Expected failures, but conditionally

Tests that are expected to fail

- on certain Python versions.
- on certain platforms like Windows.

```
class TestConvertToInt(object):
    def test_with_no_comma(self):
        """Only runs on Python 2.7 or lower"""
        test_argument = "756"
        expected = 756
        actual = convert_to_int(test_argument)
        message = unicode("Expected: 2081, Actual: {0}".format(actual)) # Requires Python 2.7 or lower
        assert actual == expected, message
```

# Test suite goes red on Python 3

pytest

```
===== test session starts =====
platform linux -- Python 3.6.8, pytest-4.3.1, py-1.8.0, pluggy-0.9.0

===== FAILURES =====
----- TestConvertToInt.test_with_no_comma -----

self = <tests.data.test_preprocessing_helpers.TestConvertToInt object at 0x7f2c479a76a0>

    def test_with_no_comma(self):
        test_argument = "756"
        expected = 756
        actual = convert_to_int(test_argument)
>       message = unicode("Expected: 2081, Actual: {}".format(actual))
E       NameError: name 'unicode' is not defined

data/test_preprocessing_helpers.py:12: NameError
===== 1 failed, 15 passed, 1 xfailed in 0.23 seconds =====
```

# skipif: skip tests conditionally

```
class TestConvertToInt(object):  
    @pytest.mark.skipif  
    def test_with_no_comma(self):  
        """Only runs on Python 2.7 or lower"""  
        test_argument = "756"  
        expected = 756  
        actual = convert_to_int(test_argument)  
        message = unicode("Expected: 2081, Actual: {0}".format(actual))  
        assert actual == expected, message
```



# skipif: skip tests conditionally

```
class TestConvertToInt(object):  
    @pytest.mark.skipif(boolean_expression)  
    def test_with_no_comma(self):  
        """Only runs on Python 2.7 or lower"""  
        test_argument = "756"  
        expected = 756  
        actual = convert_to_int(test_argument)  
        message = unicode("Expected: 2081, Actual: {0}".format(actual))  
        assert actual == expected, message
```

- If `boolean_expression` is `True`, then test is skipped.

# skipif when Python version is higher than 2.7

```
import sys

class TestConvertToInt(object):
    @pytest.mark.skipif(sys.version_info > (2, 7))
    def test_with_no_comma(self):
        """Only runs on Python 2.7 or lower"""
        test_argument = "756"
        expected = 756
        actual = convert_to_int(test_argument)
        message = unicode("Expected: 2081, Actual: {0}".format(actual))
        assert actual == expected, message
```

# The reason argument

```
import sys

class TestConvertToInt(object):
    @pytest.mark.skipif(sys.version_info > (2, 7), reason="requires Python 2.7")
    def test_with_no_comma(self):
        """Only runs on Python 2.7 or lower"""
        test_argument = "756"
        expected = 756
        actual = convert_to_int(test_argument)
        message = unicode("Expected: 2081, Actual: {0}".format(actual))
        assert actual == expected, message
```

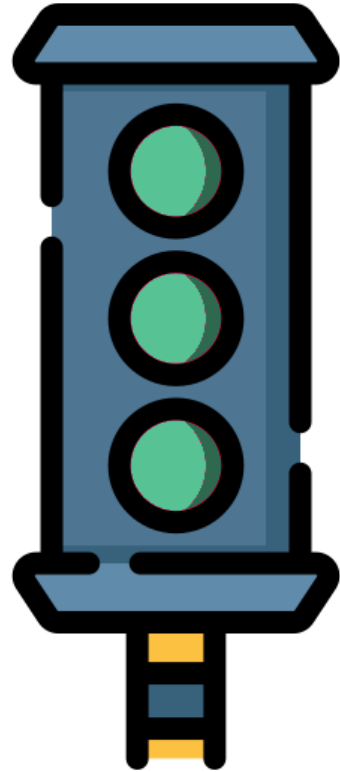
# 1 skipped, 1 xfailed

pytest

```
===== test session starts =====
platform linux -- Python 3.6.8, pytest-4.3.1, py-1.8.0, pluggy-0.9.0
collected 17 items

data/test_preprocessing_helpers.py s..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..x [100%]

===== 15 passed, 1 skipped, 1 xfailed in 0.21 seconds =====
```



# Showing reason in the test result report

```
pytest -r
```

# The -r option

```
pytest -r[set_of_characters]
```

# Showing reason for skipping

```
pytest -rs
```

```
===== test session starts =====
platform linux -- Python 3.6.8, pytest-4.3.1, py-1.8.0, pluggy-0.9.0
collected 17 items

data/test_preprocessing_helpers.py s..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..x [100%]

===== short test summary info =====
SKIPPED [1] tests/data/test_preprocessing_helpers.py:8: Requires Python 2.7 or lower

===== 15 passed, 1 skipped, 1 xfailed in 0.21 seconds =====
```



# Optional reason argument to xfail

```
import pytest

class TestTrainModel(object):
    @pytest.mark.xfail
    def test_on_linear_data(self):
        ...
```

# Optional reason argument to xfail

```
import pytest

class TestTrainModel(object):
    @pytest.mark.xfail(reason="Using TDD, train_model() is not implemented")
    def test_on_linear_data(self):
        ...
```

# Showing reason for xfail

```
pytest -rx
```

```
===== test session starts =====
platform linux -- Python 3.6.8, pytest-4.3.1, py-1.8.0, pluggy-0.9.0
collected 17 items

data/test_preprocessing_helpers.py s..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..x [100%]

===== short test summary info =====
XFAIL models/test_train.py::TestTrainModel::test_on_linear_data
    Using TDD, train_model() is not implemented

===== 15 passed, 1 skipped, 1 xfailed in 0.28 seconds =====
```

# Showing reason for both skipped and xfail

```
pytest -rsx
```

```
===== test session starts =====
platform linux -- Python 3.6.8, pytest-4.3.1, py-1.8.0, pluggy-0.9.0
rootdir: /home/dibya/startup-code/datacamp/univariate_linear_regression, inifile:
collected 17 items

data/test_preprocessing_helpers.py s..... [ 76%]
features/test_as_numpy.py . [ 82%]
models/test_train.py ..x [100%]
===== short test summary info =====
SKIPPED [1] tests/data/test_preprocessing_helpers.py:8: Requires Python 2.7 or lower
XFAIL models/test_train.py::TestTrainModel::test_on_linear_data
    Using TDD, train_model() is not implemented

===== 15 passed, 1 skipped, 1 xfailed in 0.22 seconds =====
```

# Skipping/xfailing entire test classes

```
@pytest.mark.xfail(reason="Using TDD, train_model() is not implemented")
```

```
class TestTrainModel(object):
```

```
...
```

```
@pytest.mark.skipif(sys.version_info > (2, 7), reason="requires Python 2.7")
```

```
class TestConvertToInt(object):
```

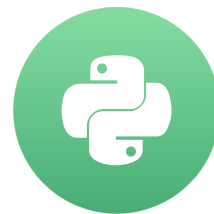
```
...
```

# Let's practice xfailing and skipping!

UNIT TESTING FOR DATA SCIENCE IN PYTHON

# Continuous integration and code coverage

UNIT TESTING FOR DATA SCIENCE IN PYTHON



**Dibya Chakravorty**  
Test Automation Engineer

# Code coverage and build status badges



Travis CI passing

AppVeyor passing

Azure Pipelines succeeded

codecov 85%

NumPy is the fundamental package needed for scientific computing with Python.

- **Website (including documentation):** <https://www.numpy.org>
- **Mailing list:** <https://mail.python.org/mailman/listinfo/numpy-discussion>



# Code coverage and build status badges



NumPy is the fundamental package needed for scientific computing with Python.

- **Website (including documentation):** <https://www.numpy.org>
- **Mailing list:** <https://mail.python.org/mailman/listinfo/numpy-discussion>

# Code coverage and build status badges



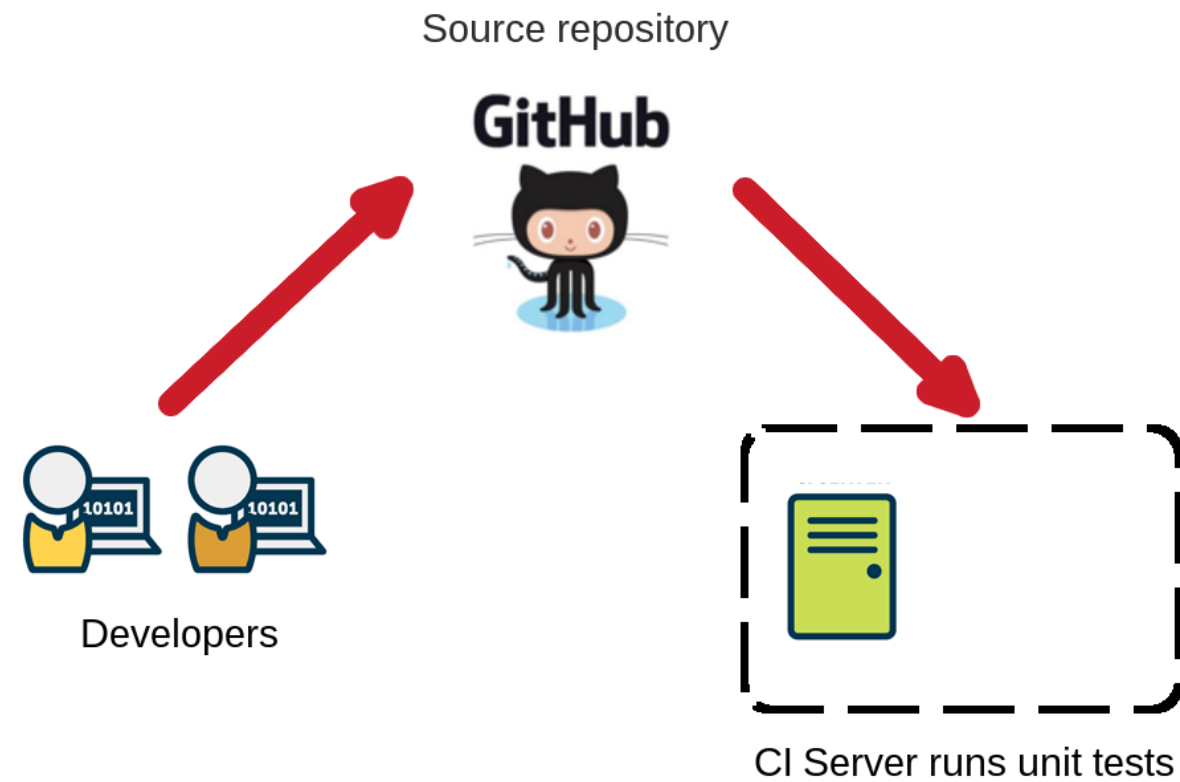
NumPy is the fundamental package needed for scientific computing with Python.

- **Website (including documentation):** <https://www.numpy.org>
- **Mailing list:** <https://mail.python.org/mailman/listinfo/numpy-discussion>

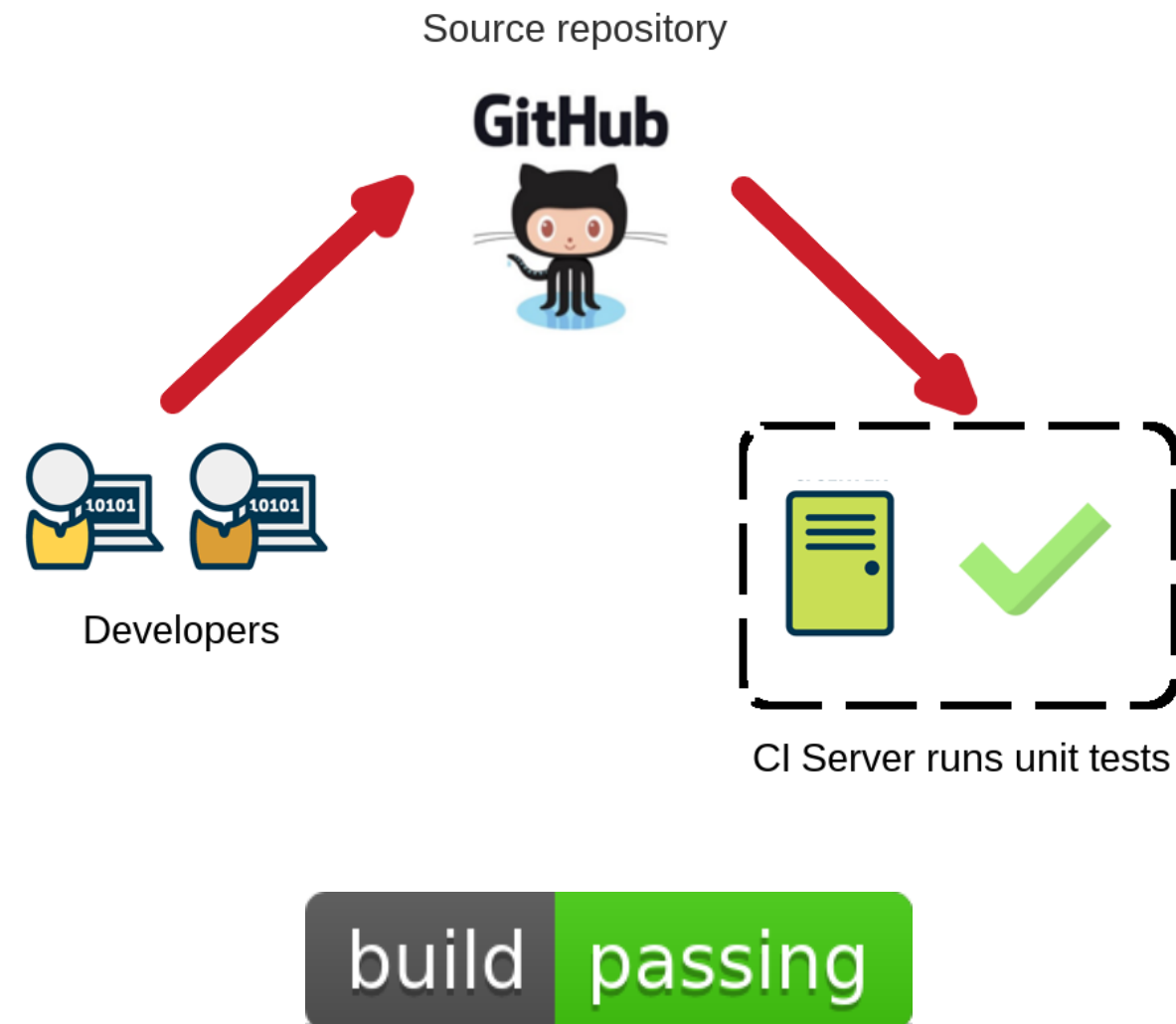
# The build status badge



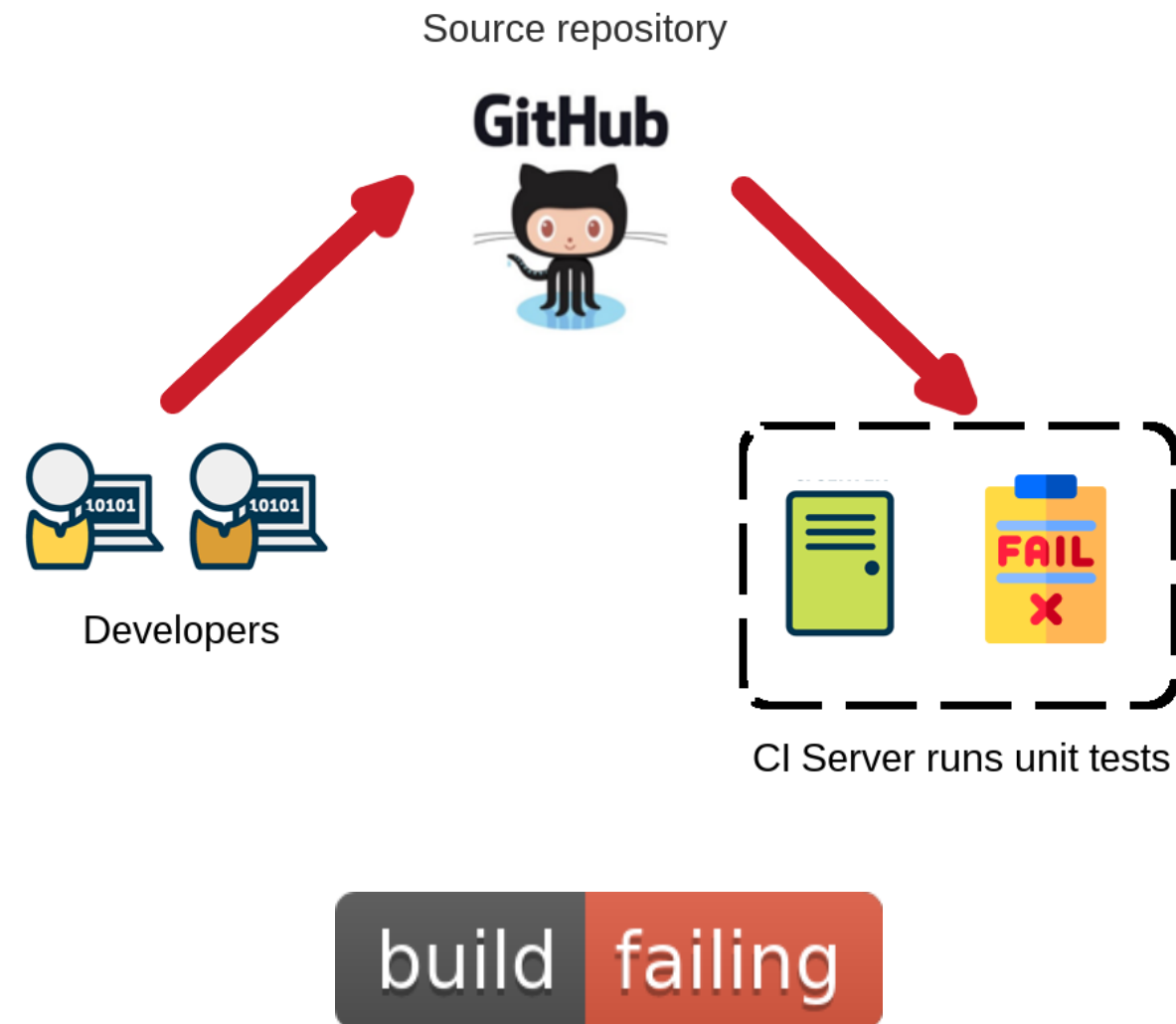
# The build status badge



# Build passing = Stable project



# Build failing = Unstable project



# CI server



# Travis CI

# Step 1: Create a configuration file

```
repository root  
|-- src  
|-- tests  
|-- .travis.yml
```



# Step 1: Create a configuration file

- Contents of `.travis.yml` .

```
language: python
python:
  - "3.6"
install:
  - pip install -e .
script:
  - pytest tests
```

# Step 2: Push the file to GitHub

```
git add .travis.yml  
git push origin master
```

# Step 3: Install the Travis CI app

The screenshot shows the GitHub interface with the 'Marketplace' tab selected. The main content area displays a list of repositories, with 'gutfeeling/beginner\_nlp' highlighted. The sidebar on the left shows the user 'gutfeeling' and a list of repositories. The right sidebar features a 'Discover repositories' section with links to 'spacy-cld', 'Python-Machine-Learning-Cookbook', and 'textblob-fr'.

**Repositories**

- datacamp/courses-unit-testing-i...
- gutfeeling/univariate-linear-regr...
- gutfeeling/version-control-workf...
- gutfeeling/pythonbooks\_heroku
- datacamp-content/courses-appl...
- datacamp-content/courses-appl...
- gutfeeling/practical\_rl\_for\_coders


Show more

**Your teams**

**Discover repositories**

- nickdavidhaynes/spacy-cld  
Language detection extension for spaCy 2.0+  
Python ★ 87
- PacktPublishing/Python-Machine-Learning-Cookbook  
Code files for Python-Machine-Learning-Cookbook  
Python ★ 259
- sloria/textblob-fr  
French language support for TextBlob.

# Step 3: Install the Travis CI app

 Search or jump to... / Pull requests Issues Marketplace Explore

Marketplace / Search results

Categories

API management

Chat

Code quality

Code review


Continuous integration

Dependency management

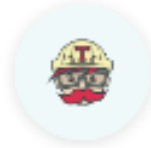
Deployment


IDEs

Learning

 travis

1 result for "travis"



Travis CI 

Test and deploy with confidence

Previous

Next

# Step 3: Install the Travis CI app

## Pricing and setup

### Open Source

We offer free CI for Open Source projects

\$0

#### ONE

Free Trial

Unlimited builds, 1 job at a time. Ideal for hobby and small projects.

\$69

/ month

#### THREE

Free Trial

Unlimited builds, 3 jobs at a time. Best suited for small teams.

\$199

/ month

#### SIX

Free Trial

Unlimited builds, 6 jobs at a time. Great for growing teams.

\$349

/ month

Travis CI

### Open Source

We offer free CI for Open Source projects

- ✓ Unlimited public repositories
- ✓ Unlimited collaborators


Account: [gutfeeling](#) ▾

Install it for free


Next: Confirm your installation location.

Travis CI is provided by a third-party and is governed by separate [terms of service](#), [privacy policy](#), and [support contact](#).

# Step 3: Install the Travis CI app



## Install Travis CI


Install on your personal account Dibya Chakravorty 

☐ **All repositories**  
This applies to all current *and* future repositories.

☒ **Only select repositories**

Select repositories ▾

Selected 1 repository

 gutfeeling/univariate-linear-regression ×

...with these permissions:

- ✓ **Read** access to code
- ✓ **Read** access to metadata and pull requests
- ✓ **Read** and **write** access to checks, commit statuses, deployments, and repository hooks

[Install](#) [Cancel](#)

Next: you'll be directed to the GitHub App's site to complete setup.

# Step 3: Install the Travis CI app

Travis CI [About Us](#) [Plans & Pricing](#) [Enterprise](#) [Help](#)



We're so glad you're here!


Please sign in to view your repositories.

Sign in with GitHub

# Every commit leads to a build

Travis CI

[Dashboard](#) [Changelog](#) [Documentation](#) [Help](#)



Search all repositories

My Repositories


Running (1/1)

+

gutfeeling/univariate-linear-reg # 13

Duration: 28 sec

gutfeeling / univariate-linear-regression



build passing

Current

Branches

Build History

Pull Requests

More options

Remove useless comment

#13 started

Cancel build

Commit 8f6c815

Compare 3695237..8f6c815

Branch master

Dibya Chakravorty

Python: 3.6

Running for 28 sec

Job log

View config



# Step 4: Showing the build status badge

Travis CI

Dashboard

Changelog

Documentation

Help

Search all repositories

My Repositories

Running (1/1)

+

gutfeeling/univariate-linear-reg # 13

Duration: 28 sec

gutfeeling / univariate-linear-regression

build passing

Current

Branches

Build History

Pull Requests

More options

master Remove useless comment

#13 started

Cancel build

Commit 8f6c815

Compare 3695237..8f6c815

Branch master

Dibya Chakravorty

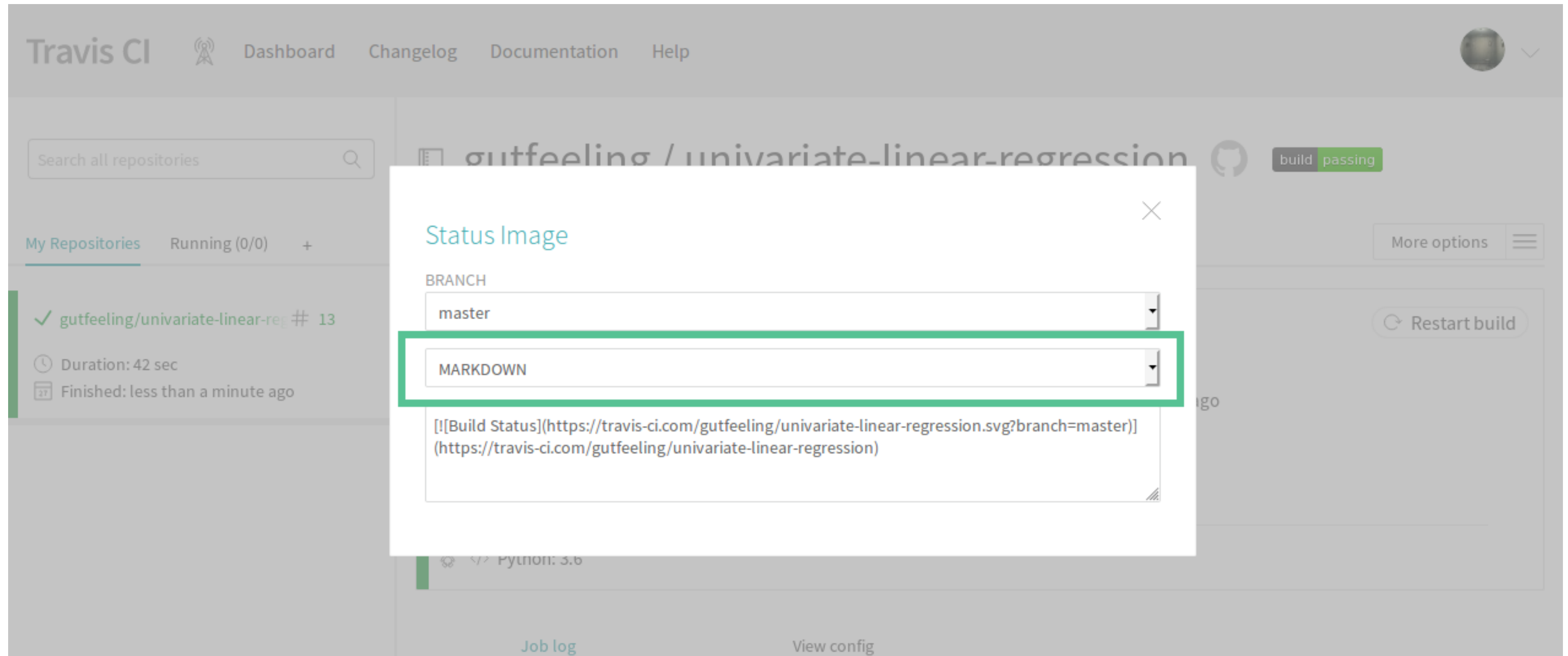
Python: 3.6

Running for 28 sec

Job log

View config

# Step 4: Showing the build status badge



The screenshot shows the Travis CI web interface. At the top, there's a navigation bar with 'Travis CI', a signal icon, and links to 'Dashboard', 'Changelog', 'Documentation', and 'Help'. Below this is a search bar labeled 'Search all repositories'. The main content area shows a repository 'gutfeeling / univariate-linear-regression' with a 'build passing' status. A modal window titled 'Status Image' is open, showing a dropdown menu with 'master' selected. Below the dropdown, the 'MARKDOWN' option is highlighted with a green border. The modal also displays the generated markdown code: `[![Build Status](https://travis-ci.com/gutfeeling/univariate-linear-regression.svg?branch=master)](https://travis-ci.com/gutfeeling/univariate-linear-regression)`. The background shows a list of repositories with a green checkmark for the current one, and a 'Restart build' button.

Travis CI Dashboard Changelog Documentation Help

Search all repositories

My Repositories Running (0/0) +

✓ gutfeeling/univariate-linear-reg # 13

⌚ Duration: 42 sec

📅 Finished: less than a minute ago

gutfeeling / univariate-linear-regression build passing

More options

Restart build

Python: 3.6

Job log View config

Status Image


BRANCH

master









MARKDOWN



[![Build Status](https://travis-ci.com/gutfeeling/univariate-linear-regression.svg?branch=master)](https://travis-ci.com/gutfeeling/univariate-linear-regression)


# Step 4: Showing the build status badge

 **gutfeeling** Remove codecov badge

Latest commit e08b854 now

 <a href="#">data/raw</a>	Add tests	2 months ago
 <a href="#">notebooks</a>	Fix jupyter notebook	2 months ago
 <a href="#">src</a>	remove fake data generator	4 days ago
 <a href="#">tests</a>	Better test for float valued string	4 days ago
 <a href="#">.gitignore</a>	Improved gitignore	3 months ago
 <a href="#">.travis.yml</a>	Remove comments	4 days ago
 <a href="#">README.md</a>	Remove codecov badge	now
 <a href="#">setup.py</a>	Remove useless comment	3 minutes ago

 **README.md** 



# Code coverage



- $\text{code coverage} = \frac{\text{num lines of application code that ran during testing}}{\text{total num lines of application code}} \times 100$
- Higher percentages (75% and above) indicate well tested code.

# Codecov



# Step 1: Modify the Travis CI configuration file

- File: `.travis.yml`

```
language: python
python:
  - "3.6"
install:
  - pip install -e .

script:
  - pytest tests
```

# Step 1: Modify the Travis CI configuration file

- File: `.travis.yml`

```
language: python
python:
  - "3.6"
install:
  - pip install -e .
  - pip install pytest-cov codecov      # Install packages for code coverage report
script:
  - pytest tests
```

# Step 1: Modify the Travis CI configuration file

- File: `.travis.yml`

```
language: python
python:
  - "3.6"
install:
  - pip install -e .
  - pip install pytest-cov codecov      # Install packages for code coverage report
script:
  - pytest --cov=src tests              # Point to the source directory
```




# Step 1: Modify the Travis CI configuration file




- File: `.travis.yml`

```
language: python
python:
  - "3.6"
install:
  - pip install -e .
  - pip install pytest-cov codecov      # Install packages for code coverage report
script:
  - pytest --cov=src tests              # Point to the source directory
after_success:
  - codecov                             # uploads report to codecov.io
```

# Step 2: Install Codecov



[Pull requests](#) [Issues](#) [Marketplace](#) [Explore](#)



  

[Marketplace](#) / Search results

### Categories

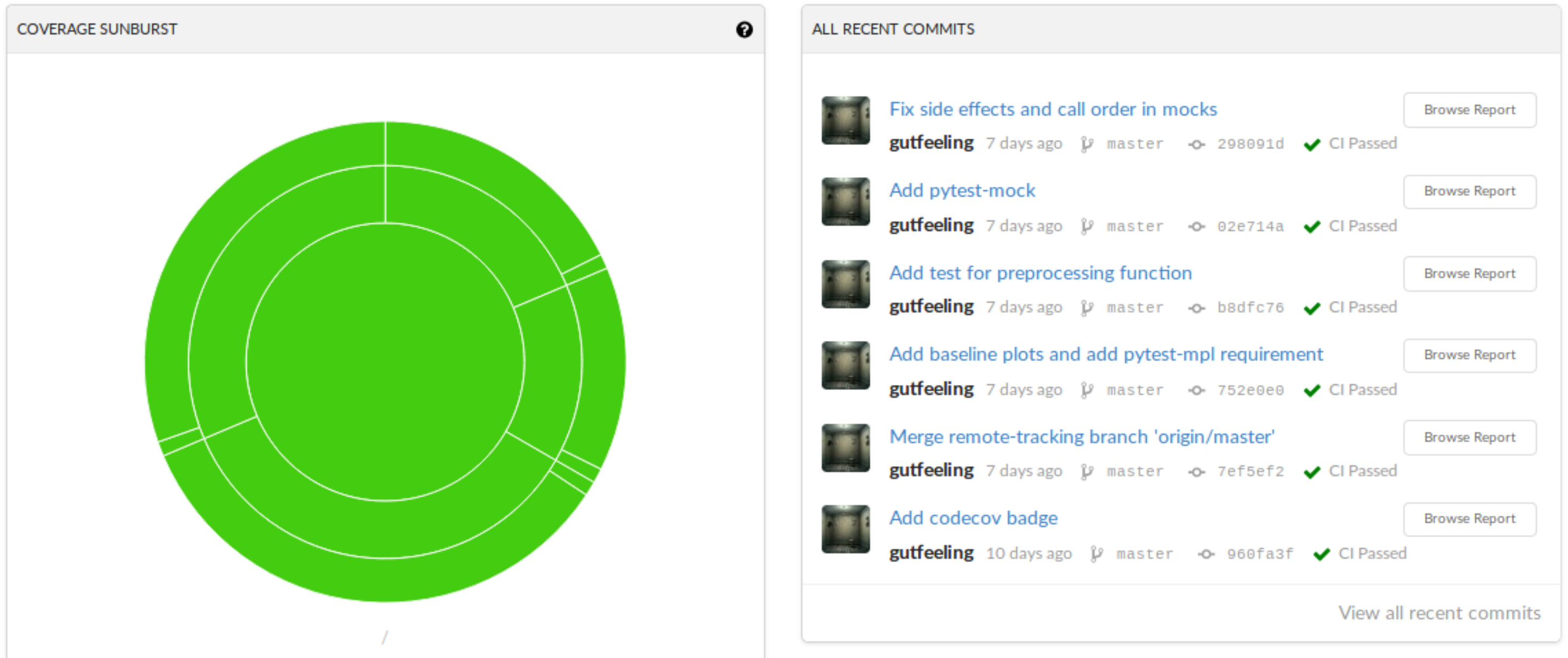
- API management
- Chat
- Code quality
- Code review
- Continuous integration
- Dependency management
- Deployment
- IDEs
- Learning

**1 result** for "codecov"

**Codecov**   
Group, merge, archive and compare coverage reports

[Previous](#) [Next](#)

# Commits lead to coverage report at codecov.io



# Step 3: Showing the badge in GitHub

The screenshot shows the GitHub repository settings page for the repository 'gutfeeling/univariate-linear-regression'. The 'Settings' tab is selected in the top navigation bar. On the left sidebar, the 'Badge' section is highlighted. The main content area displays three tabs: 'Markdown', 'HTML', and 'RST'. The 'Markdown' tab is active and highlighted with a green border. It contains a code snippet for a Codecov badge, with a 'Copy' button to its right. The 'HTML' and 'RST' tabs also have 'Copy' buttons. The 'HTML' tab shows the corresponding HTML code for the badge. The 'RST' tab shows the corresponding RST code for the badge.

General  
Yaml  
**Badge**

**Markdown** [Copy](#)

```
[![codecov](https://codecov.io/gh/gutfeeling/univariate-linear-regression/branch/master/graph)]
```


**HTML** [Copy](#)

```
<a href="https://codecov.io/gh/gutfeeling/univariate-linear-regression">  
  
```



**RST** [Copy](#)


```
.. image:: https://codecov.io/gh/gutfeeling/univariate-linear-regression/branch/master/graph.  
   :target: https://codecov.io/gh/gutfeeling/univariate-linear-regression
```

# Step 3: Showing the badge in GitHub

 **gutfeeling** Update README.md Latest commit 0d34ed3 4 minutes ago

data	Match the course code	12 minutes ago
notebooks	Match the course code	12 minutes ago
src	Match the course code	12 minutes ago
tests	Match the course code	12 minutes ago
.gitignore	Improved gitignore	4 months ago
.travis.yml	Remove comments	2 months ago
README.md	Update README.md	4 minutes ago
setup.py	Add pytest-mock	2 months ago

 **README.md** 

build passing  90%

This repository holds the code for the DataCamp course Unit Testing for Data Science in Python by Dibya Chakravorty.

# Let's practice CI and code coverage!

UNIT TESTING FOR DATA SCIENCE IN PYTHON