Introduction

Jiaze Li

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The University of Hong Kong

Overview

Python Installation

Python

- In this course, we will use **Python** for textual analysis.
- Why?
    - Python has rich libraries for textual analysis.
    - Python has clear syntax.
    - AI agents are good at Python.

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- The best way to install Python is **NOT** to install Python.

- The standard way to install Python is through `conda`, an open-source package and environment manager.
    - I recommend `conda-forge`, a community-led channel. See `https://conda-forge.org/`.

- If you need to use advanced modules like `torch`, consider installing Python through `uv`, a fast package manager. See `https://docs.astral.sh/uv/`.

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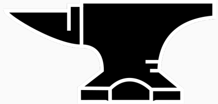

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Startup

- You can check if you have `conda-forge` installed correctly by running `conda --version` in your Miniforge Prompt (Windows) or Terminal (macOS/Linux).
    - For Windows users, if you want to use `conda` in Terminal, you should run `conda init` in Miniforge Prompt once.
- Your terminal should look like these:
    - `(base) C:\Users\Jiaze Li>`
    - `(base) jiaze@jiaze-legion:~$`

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Environments

- `conda` is a package and environment manager.
  - Packages are collections of code that provide specific functionality.
    - Examples: `pandas`, `matplotlib`, etc.
  - Environments are isolated spaces where you can install packages without affecting other environments.
- To create a new environment, run `conda create -n <env_name> python=<version>` in your Terminal.
  - For example, `conda create -n py312 python=3.12` will create a new environment named `py312` with Python 3.12 installed.
- For many commands (not only `conda`), you may see `Proceed ([y]/n)?`. If you know what you are doing, type `y` and press `Enter`.

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Environments (Cont.)

- To list all your environments, run `conda env list`.
    - `base` is the default environment that comes with `conda`. You should avoid installing packages in the `base` environment to prevent conflicts.
- To activate the environment, run `conda activate <env_name>`.
    - Every time you run commands in the terminal, you should make sure you are in the correct environment.
    - Once you activate the environment, your terminal should look like these:
        - `(py312) C:\Users\Jiaze Li>`
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Packages

- To install packages in the activated environment, run `conda install <package_name_1> <package_name_2> ...`.
  - For example, `conda install jupyterlab pandas` will install the `jupyterlab` and `pandas` packages in the currently activated environment.
- Not all packages are available on `conda-forge`. You should check the official documentation of the package for installation instructions.
  - For example, `torch` no longer supports installation through `conda` since version 2.6.0.
- Recommended packages for general use:
  - `jupyterlab`: Add support for .ipynb files, which are interactive notebooks that allow you to run code and see the output in the same document.
  - `pandas`: A powerful library for data manipulation and analysis

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IDE

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- In principle, you can write any code in any text editor like Notepad, but an Integrated Development Environment (IDE) can provide useful features like syntax highlighting, code completion, debugging, etc.
- I recommend using Visual Studio Code, an open-source code editor developed by Microsoft. See `https://code.visualstudio.com/`.
- You may also consider Cursor, a code editor based on VS Code that integrates AI features. See `https://www.cursor.com/`.
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Extensions

- Extensions for Python development:
  - Python: Provides rich support for Python development. See `https://marketplace.visualstudio.com/items?itemName=ms-python.python`.
  - Jupyter: Provides support for Jupyter notebooks. See `https://marketplace.visualstudio.com/items?itemName=ms-toolsai.jupyter`.
- Recommended extensions for Python development:
  - GitHub Copilot Chat: Provides AI-powered code suggestions and explanations. See `https://marketplace.visualstudio.com/items?itemName=GitHub.copilot-chat`.
  - Data Wrangler: Provides a visual interface for data manipulation and analysis. See `https://marketplace.visualstudio.com/items?itemName=ms-toolsai.datawrangler`.

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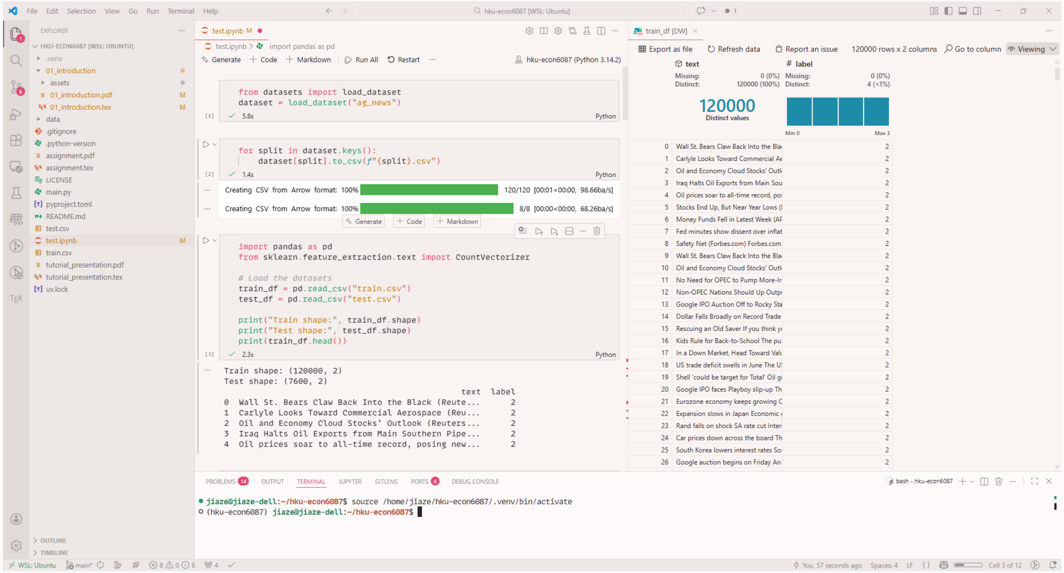

```python
from datasets import load_dataset
dataset = load_dataset("ag_news")
```
[1] ✓ 5.8s Python

```python
for split in dataset.keys():
    dataset[split].to_csv(f"{split}.csv")
```
[2] ✓ 1.4s Python

```
Creating CSV from Arrow format: 100%  120/120 [00:01<00:00, 98.66ba/s]
Creating CSV from Arrow format: 100%  8/8 [00:00<00:00, 68.26ba/s]
```

```python
import pandas as pd
from sklearn.feature_extraction.text import CountVectorizer

# Load the datasets
train_df = pd.read_csv("train.csv")
test_df = pd.read_csv("test.csv")

print("Train shape:", train_df.shape)
print("Test shape:", test_df.shape)
print(train_df.head())
```
[3] ✓ 2.3s Python

```
Train shape: (120000, 2)
Test shape: (7600, 2)
                                                text  label
0  Wall St. Bears Claw Back Into the Black (Reute...      2
1  Carlyle Looks Toward Commercial Aerospace (Reu...      2
2  Oil and Economy Cloud Stocks' Outlook (Reuters...      2
3  Iraq Halts Oil Exports from Main Southern Pipe...      2
4  Oil prices soar to all-time record, posing new...      2
```

text — Missing: 0 (0%) Distinct: 120000 (100%) — 120000 Distinct values

label — Missing: 0 (0%) Distinct: 4 (<1%) — Min 0 Max 3

	text	label
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5	Stocks End Up, But Near Year Lows (I	2
6	Money Funds Fell in Latest Week (AF	2
7	Fed minutes show dissent over inflat	2
8	Safety Net (Forbes.com) Forbes.com	2
9	Wall St. Bears Claw Back Into the Bla	2
10	Oil and Economy Cloud Stocks' Outl	2
11	No Need for OPEC to Pump More-Ir	2
12	Non-OPEC Nations Should Up Outpu	2
13	Google IPO Auction Off to Rocky Sta	2
14	Dollar Falls Broadly on Record Trade	2
15	Rescuing an Old Saver If you think yo	2
16	Kids Rule for Back-to-School The pu	2
17	In a Down Market, Head Toward Valu	2
18	US trade deficit swells in June The U:	2
19	Shell 'could be target for Total' Oil gi	2
20	Google IPO faces Playboy slip-up Th	2
21	Eurozone economy keeps growing C	2
22	Expansion slows in Japan Economic	2
23	Rand falls on shock SA rate cut Inter	2
24	Car prices down across the board Th	2
25	South Korea lowers interest rates So	2
26	Google auction begins on Friday An	2

```
jiaze@jiaze-dell:~/hku-econ6087$ source /home/jiaze/hku-econ6087/.venv/bin/activate
(hku-econ6087) jiaze@jiaze-dell:~/hku-econ6087$
```

Python

Running Your First Code

- Create a new file and save it with the `.ipynb` extension (Jupyter Notebook).

- At the upper-right corner of the VS Code editor, click ”Select Kernel” and choose the `conda` environment we created.

- Type the following in a code cell and run it.

```python
print("Hello, World!")
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Function

- The `print()` function is technically defined as follows:

```
def print(
    *values: object,
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    end: str | None = "\n",
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Type

- Every value is an object, and every object has a type.
- You can check the type of an object using the `type()` function.

```python
type("Hello, World!")  # str
type(42)               # int
type(3.14)             # float
type(True)             # bool
type([1, 2, 3])        # list
type((1, 2, 3))        # tuple
type({"a": 1, "b": 2}) # dict
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- This is useful when you see `TypeError: ...` in your code, which means you are using a value of the wrong type.

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pandas

- `pandas` is a powerful package for data manipulation and analysis.
- It introduces two classes that can hold any type.
  - `Series`, a one-dimensional labeled array (Column)
  - `DataFrame`, a two-dimensional labeled data structure (Table)
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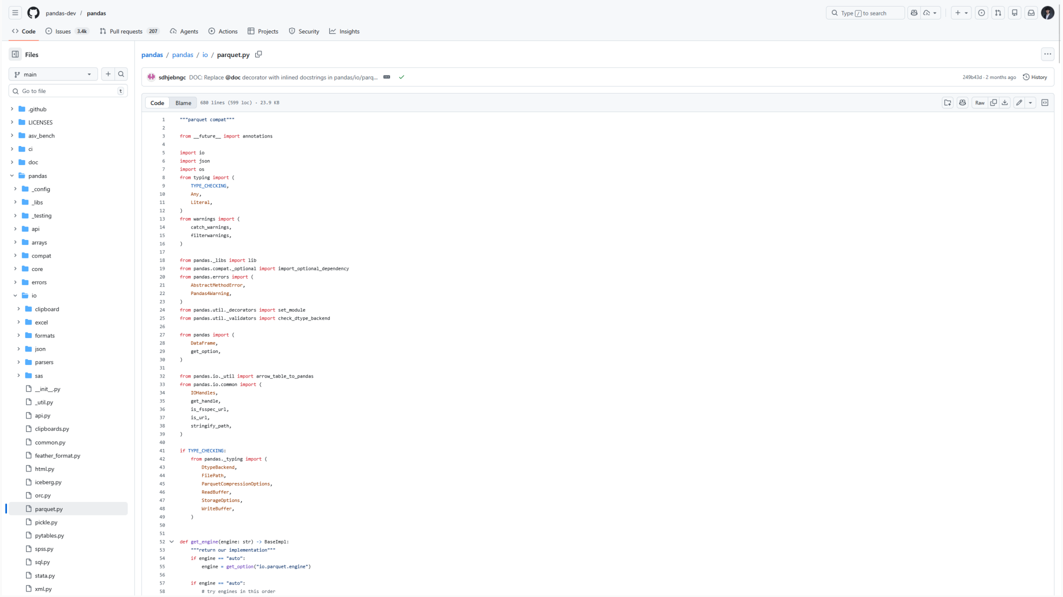

sdhjebngc DOC: Replace @doc decorator with inlined docstrings in pandas/io/parq...

680 lines (599 loc) · 23.9 KB

```python
"""parquet compat"""

from __future__ import annotations

import io
import json
import os
from typing import (
    TYPE_CHECKING,
    Any,
    Literal,
)
from warnings import (
    catch_warnings,
    filterwarnings,
)

from pandas._libs import lib
from pandas.compat._optional import import_optional_dependency
from pandas.errors import (
    AbstractMethodError,
    Pandas4Warning,
)
from pandas.util._decorators import set_module
from pandas.util._validators import check_dtype_backend

from pandas import (
    DataFrame,
    get_option,
)

from pandas.io._util import arrow_table_to_pandas
from pandas.io.common import (
    IOHandles,
    get_handle,
    is_fsspec_url,
    is_url,
    stringify_path,
)

if TYPE_CHECKING:
    from pandas._typing import (
        DtypeBackend,
        FilePath,
        ParquetCompressionOptions,
        ReadBuffer,
        StorageOptions,
        WriteBuffer,
    )


def get_engine(engine: str) -> BaseImpl:
    """return our implementation"""
    if engine == "auto":
        engine = get_option("io.parquet.engine")

    if engine == "auto":
        # try engines in this order
```

pandas (Cont.)

- To use any package, you need to import it first.

```
import pandas as pd
```

- This line imports the **`pandas`** package and names it **`pd`** for short.

- You can now use the functions in **`pandas`** by **`pd.function_name()`**.
  - For example, **`pd.DataFrame()`** is a function that returns a new DataFrame object.

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- You can check them using the `dir()` function.

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df = pd.DataFrame({
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- For all packages, you can learn via the following channels:
  - Official documentation (`https://pandas.pydata.org/docs/` for `pandas`)
  - AI agents
    - You need to be extremely careful when using AI agents to learn packages. The core reason is that many AI agents are trained on the previous version of a package, which can be very different from the current version.
    - For example, AI agents used to suggest `pd.DataFrame.append()` for adding a new row, but this method has become deprecated since version 1.4.0.
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sklearn

- `sklearn` is a powerful package for machine learning.
- To install `sklearn`, run `conda install scikit-learn`.
- It provides many functions for data preprocessing, model training, evaluation, etc.

- For the first assignment, we will use the `CountVectorizer` (BoW), `TfidfVectorizer` (TF-IDF), and `KNeighborsClassifier` (KNN) functions in `sklearn`.

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`CountVectorizer`

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- `CountVectorizer` is a class with the following parameters, attributes, and methods.
  - `from sklearn.feature_extraction.text import CountVectorizer`
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tokenizer

- The `tokenizer` parameter is a function that takes a string as input and returns a list of tokens (words).
- If you don't specify a `tokenizer`, `CountVectorizer` will use a default tokenizer that splits the string into words based on whitespace and punctuation.
  - For example, the string "Hello, World!" will be tokenized into ["Hello", "World"].
- You can also specify a custom `tokenizer` if you want to use a different tokenization method.
  - For example, you can use `jieba` for Chinese tokenization. Then, the string `"你好，世界！"` will be tokenized into `["你好", "，", "世界", "！"]`.

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- The `stop_words` parameter is a list of words that will be ignored during tokenization.
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  - For example, you can use a custom list of stop words for Chinese, including `"综上所述"`, `"总的来看"`, `"总的来说"`. You may refer to `https://github.com/goto456/stopwords/tree/master`.

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- The `token_pattern` parameter is a regular expression that defines the pattern for tokenization.
- The default value is `r'(?u)\b\w\w+\b'`, which means that tokens must be at least 2 characters long and consist of word characters (letters, digits, or underscores).
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- The `transform` method transforms the input data into a document-term matrix based on the learned vocabulary.
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Further Reading

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- For more details on `KNeighborsClassifier`, please refer `https://scikit-learn.org/stable/modules/generated/sklearn.neighbors.KNeighborsClassifier.html` and `https://scikit-learn.org/stable/modules/neighbors.html#classification`.

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AI Agents

- Some of the students have already submitted the first assignment with the help of AI agents.
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    - "I am working in a uv project and have already run uv add datasets pandas scikit-learn. Based on the first question in #file:assignment_1.tex, generate Python code for a Jupyter Notebook. The code must load the ag_news dataset from Hugging Face using the datasets library. Provide the solution logic for the question using pandas for data manipulation."

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