Welcome to the course!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Hugo Bowne-Anderson
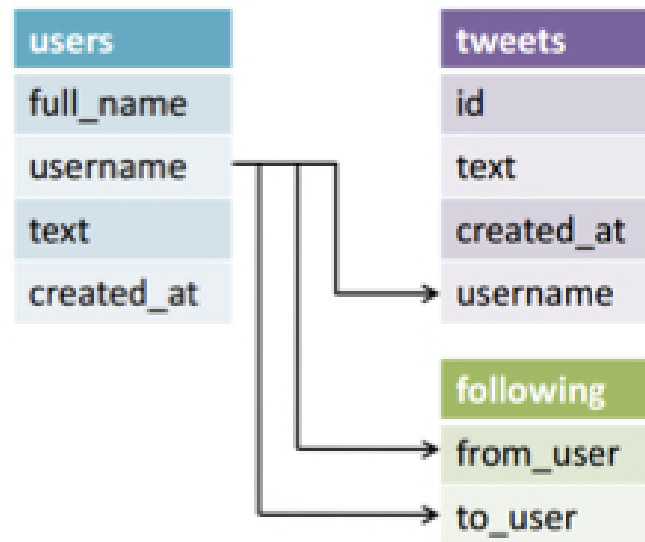Data Scientist at DataCamp

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Import data

- Flat files, e.g. .txts, .csvs

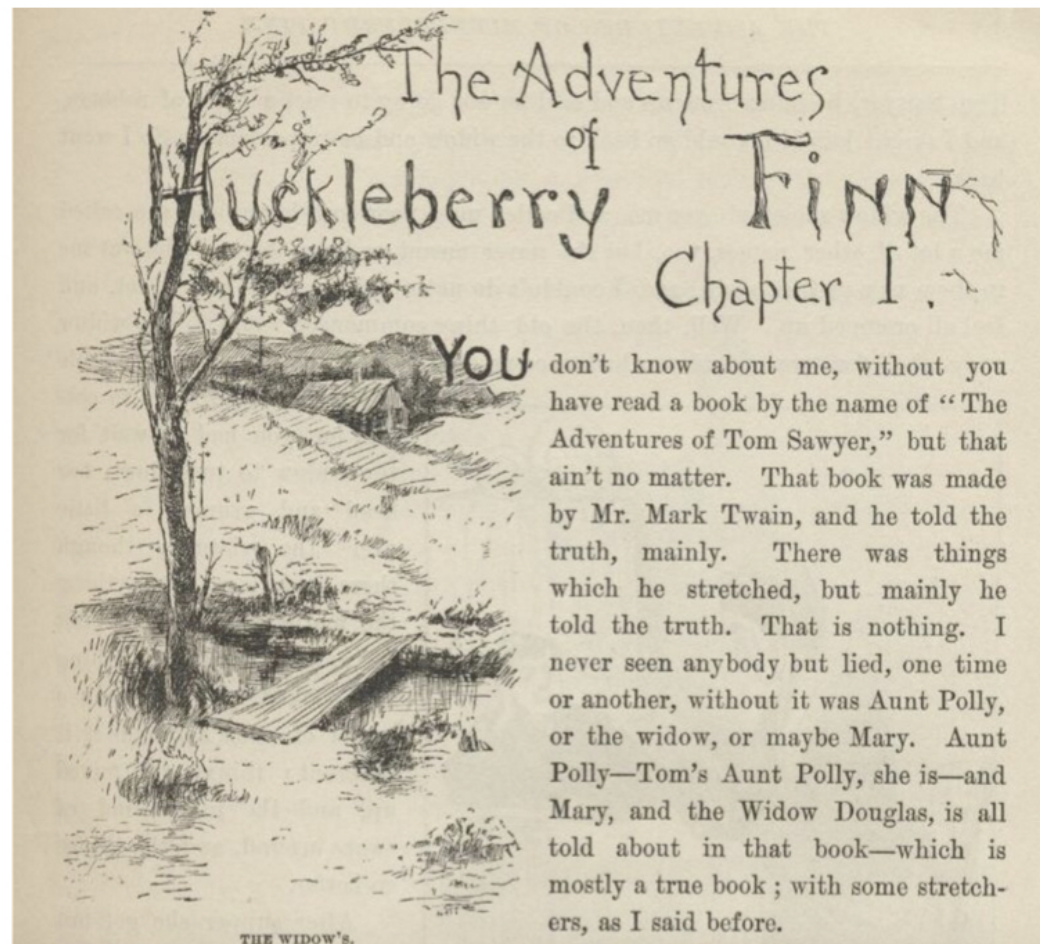- Files from other software

Import data

- Flat files, e.g. .txts, .csvs

- Files from other software

- Relational databases

Plain text files

Source: Project Gutenberg

Table data

```
                     Name     Sex  Cabin  Survived
    Braund, Mr. Owen Harris    male    NaN         0
 Cumings, Mrs. John Bradley  female    C85         1
     Heikkinen, Miss. Laina  female    NaN         1
 Futrelle, Mrs. Jacques Heath  female   C123        1
    Allen, Mr. William Henry    male    NaN         0
```

[1] Source: Kaggle

Table data

titanic.csv

```
                     Name      Sex   Cabin  Survived
      Braund, Mr. Owen Harris   male     NaN         0
   Cumings, Mrs. John Bradley  female    C85         1
       Heikkinen, Miss. Laina  female    NaN         1
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```

- Flat file

Reading a text file

```python
filename = 'huck_finn.txt'
file = open(filename, mode='r')  # 'r' is to read
text = file.read()
file.close()
```

Printing a text file

```
print(text)
```

```
YOU don't know about me without you have read a book by
the name of The Adventures of Tom Sawyer; but that
ain't no matter. That book was made by Mr. Mark Twain,
and he told the truth, mainly. There was things which
he stretched, but mainly he told the truth.  That is
nothing. never seen anybody but lied one time or
another, without it was Aunt Polly, or the widow, or
maybe Mary. Aunt Polly--Tom's Aunt Polly, she is--and
Mary, and the Widow Douglas is all told about in that
book, which is mostly a true book, with some
stretchers, as I said before.
```

Writing to a file

```python
filename = 'huck_finn.txt'
file = open(filename, mode='w')  # 'w' is to write
file.close()
```

Context manager with

```python
with open('huck_finn.txt', 'r') as file:
    print(file.read())
```

```
YOU don't know about me without you have read a book by
the name of The Adventures of Tom Sawyer; but that
ain't no matter. That book was made by Mr. Mark Twain,
and he told the truth, mainly. There was things which
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```

In the exercises, you'll:

- Print files to the console

- Print specific lines

- Discuss flat files

Let's practice!

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The importance of flat files in data science

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Data Scientist at DataCamp

Flat files

`titanic.csv`

```
PassengerId,Survived,Pclass,Name,Gender,Age,SibSp,Parch,Ticket,Fare,Cabin,Embarked
1,0,3,"Braund, Mr. Owen Harris",male,22,1,0,A/5 21171,7.25,,S
2,1,1,"Cumings, Mrs. John Bradley",female,38,1,0,PC 17599,71.2833,C85,C
3,1,3,"Heikkinen, Miss. Laina",female,26,0,0,STON/O2.3101282,7.925,,S
```

Flat files

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```

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    Cumings, Mrs. John Bradley  female  C85        1
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```

Flat files

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      Heikkinen, Miss. Laina    female    NaN         1
```

Flat files

- Text files containing records

- That is, table data

- Record: row of fields or attributes

`titanic.csv`

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1,0,3,"Braund, Mr. Owen Harris",male,22,1,0,A/5 21171,7.25,,S
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Flat files

- Text files containing records

- That is, table data

- Record: row of fields or attributes

- Column: feature or attribute

`titanic.csv`

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```

Header

`titanic.csv`

```
----------------------------------------------------------------
PassengerId,Survived,Pclass,Name,Gender,Age,SibSp,Parch,Ticket,Fare,Cabin,Embarked

----------------------------------------------------------------
1,0,3,"Braund, Mr. Owen Harris",male,22,1,0,A/5 21171,7.25,,S
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`titanic.csv`

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----------------------------------------------------------------
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2,1,1,"Cumings, Mrs. John Bradley",female,38,1,0,PC 17599,71.2833,C85,C
3,1,3,"Heikkinen, Miss. Laina",female,26,0,0,STON/O2.3101282,7.925,,S
```

File extension

- .csv - Comma separated values

- .txt - Text file

- commas, tabs - Delimiters

Tab-delimited file

MNIST.txt

pixel149	pixel150	pixel151	pixel152	pixel153
0	0	0	0	0
86	250	254	254	254
0	0	0	9	254
0	0	0	0	0
103	253	253	253	253
0	0	0	0	0
0	0	0	0	0
0	0	0	0	41
253	253	253	253	253

Tab-delimited file

`MNIST.txt`

```
pixel149        pixel150        pixel151        pixel152        pixel153
0               0               0               0               0
86              250             254             254             254
0               0               0               9               254
0               0               0               0               0
103             253             253             253             253
0               0               0               0               0
0               0               0               0               0
0               0               0               0               41
253             253             253             253             253
```
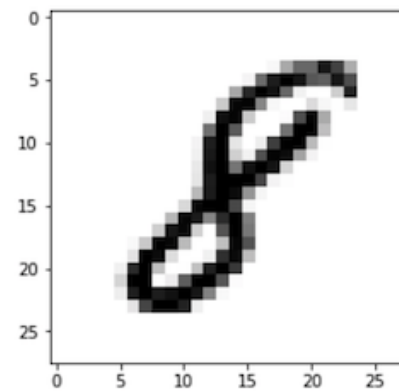
MNIST image:

How do you import flat files?

- Two main packages: NumPy, pandas

- Here, you'll learn to import:
  - Flat files with numerical data (MNIST)

  - Flat files with numerical data and strings (titanic.csv)

Let's practice!

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Importing flat files using NumPy

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Why NumPy?

- NumPy arrays: standard for storing numerical data

Why NumPy?

- NumPy arrays: standard for storing numerical data

- Essential for other packages: e.g. scikit-learn

- loadtxt()

- genfromtxt()

Importing flat files using NumPy

```python
import numpy as np
filename = 'MNIST.txt'
data = np.loadtxt(filename, delimiter=',')
data
```

```
[[   0.    0.    0.    0.    0.]
 [  86.  250.  254.  254.  254.]
 [   0.    0.    0.    9.  254.]
 ...,
 [   0.    0.    0.    0.    0.]
 [   0.    0.    0.    0.    0.]
 [   0.    0.    0.    0.    0.]]
```

Customizing your NumPy import

```python
import numpy as np
filename = 'MNIST_header.txt'
data = np.loadtxt(filename, delimiter=',', skiprows=1)
print(data)
```

```
[[   0.    0.    0.    0.    0.]
 [  86.  250.  254.  254.  254.]
 [   0.    0.    0.    9.  254.]
 ...,
 [   0.    0.    0.    0.    0.]
 [   0.    0.    0.    0.    0.]
 [   0.    0.    0.    0.    0.]]
```

- `skiprows` : *how many rows* (not indices) you wish to skip

Customizing your NumPy import

```python
import numpy as np
filename = 'MNIST_header.txt'
data = np.loadtxt(filename, delimiter=',', skiprows=1, usecols=[0, 2])
print(data)
```

```
[[   0.    0.]
 [  86.  254.]
 [   0.    0.]
 ...,
 [   0.    0.]
 [   0.    0.]
 [   0.    0.]]
```

- `usecols` : list of the indices of the columns you wish to keep

Customizing your NumPy import

```python
data = np.loadtxt(filename, delimiter=',', dtype=str)
```

Mixed datatypes

`titanic.csv`

	Name	Sex	Cabin	Fare
Braund, Mr. Owen Harris	male	NaN	7.3	
Cumings, Mrs. John Bradley	female	C85	71.3	
Heikkinen, Miss. Laina	female	NaN	8.0	
Futrelle, Mrs. Jacques Heath	female	C123	53.1	
Allen, Mr. William Henry	male	NaN	8.05	

[1] Source: Kaggle

Mixed datatypes

`titanic.csv`

```
                        Name      Sex  Cabin    Fare
      Braund, Mr. Owen Harris     male    NaN     7.3
 Cumings, Mrs. John Bradley     female    C85    71.3
      Heikkinen, Miss. Laina     female    NaN     8.0
  Futrelle, Mrs. Jacques Heath   female   C123    53.1
    Allen, Mr. William Henry     male    NaN    8.05
                            ^                       ^

                        strings                  floats
```

Let's practice!

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Importing flat files using pandas

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What a data scientist needs

- Two-dimensional labeled data structure(s)

- Columns of potentially different types

- Manipulate, slice, reshape, groupby, join, merge

- Perform statistics

- Work with time series data

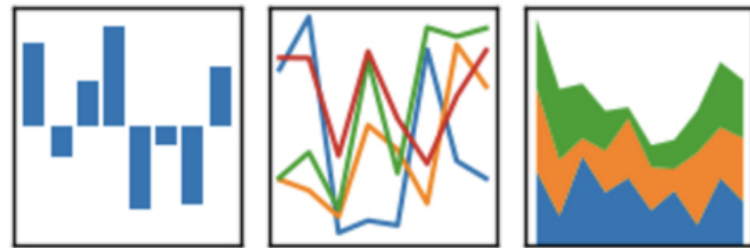# Pandas and the DataFrame
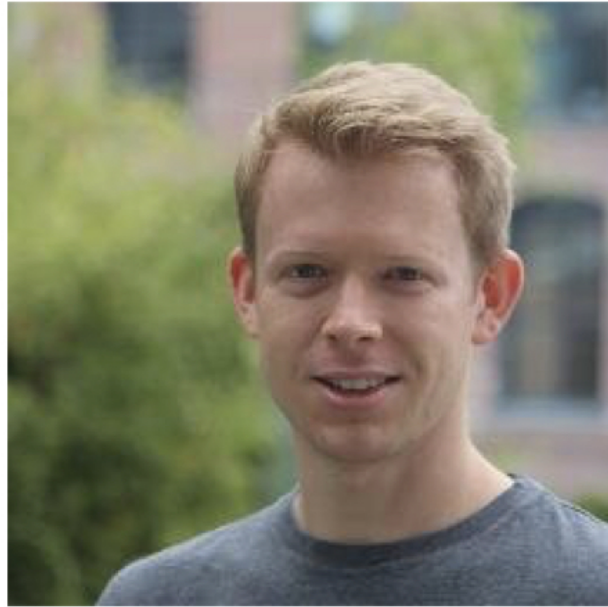
Wes McKinney

Pandas and the DataFrame

Wes McKinney

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

Pandas and the DataFrame

What problem does *pandas* solve?

Python has long been great for data munging and preparation, but less so for data analysis and modeling. *pandas* helps fill this gap, enabling you to carry out your entire data analysis workflow in Python without having to switch to a more domain specific language like R.

- DataFrame = pythonic analog of R's data frame

Pandas and the DataFrame

Hadley Wickham
@hadleywickham

A matrix has rows and columns. A data frame has observations and variables. #rstats #tidydata

RETWEETS 128   LIKES 233

Manipulating pandas DataFrames

- Exploratory data analysis

- Data wrangling

- Data preprocessing

- Building models

- Visualization

- Standard and best practice to use pandas

Importing using pandas

```python
import pandas as pd
filename = 'winequality-red.csv'
data = pd.read_csv(filename)
data.head()
```

```
   volatile acidity  citric acid  residual sugar
0              0.70         0.00             1.9
1              0.88         0.00             2.6
2              0.76         0.04             2.3
3              0.28         0.56             1.9
4              0.70         0.00             1.9
```

```python
data_array = data.to_numpy()
```

You'll experience:

- Importing flat files in a straightforward manner

- Importing flat files with issues such as comments and missing values

Let's practice!

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Final thoughts on data import

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Next chapters:

- Import other file types:
  - Excel, SAS, Stata

- Interact with relational databases

Next course:

- Scrape data from the web

- Interact with APIs

Let's practice!

INTRODUCTION TO IMPORTING DATA IN PYTHON

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