



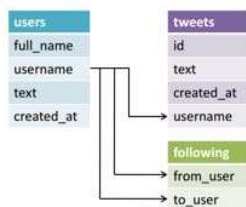
IMPORTING DATA IN PYTHON I

**Welcome to the
course!**



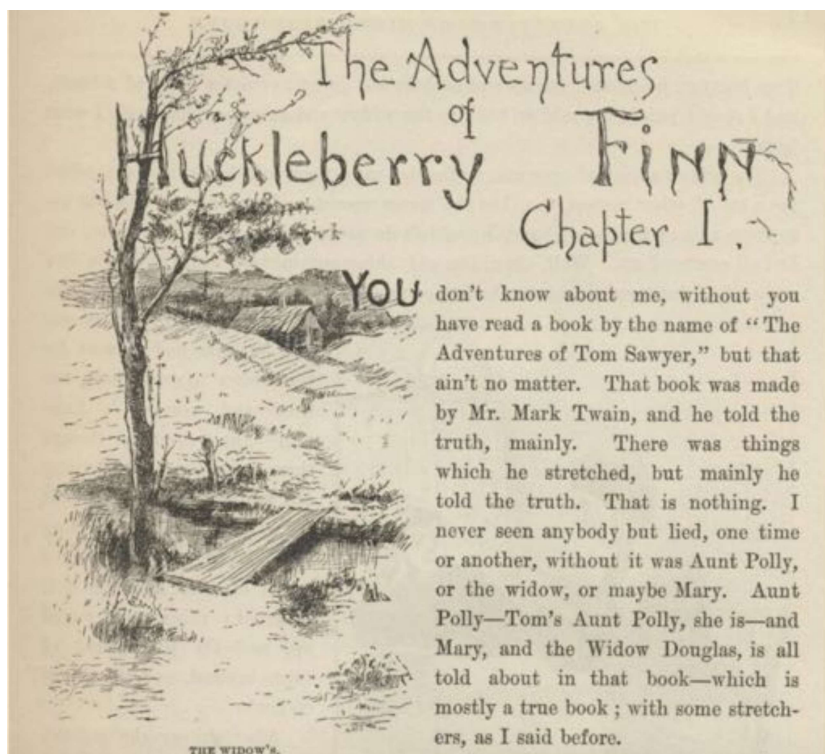
Import data

- Flat files, e.g. .txts, .csvs
- Files from other software
- Relational databases





Plain text files



Source: Project Gutenberg



Table data

titanic.csv

				row
				↓
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	

column

↑

- Flat file

Reading a text file

```
In [1]: filename = 'huck_finn.txt'

In [2]: file = open(filename, mode='r') # 'r' is to read

In [3]: text = file.read()

In [4]: file.close()
```

Printing a text file

```
In [5]: 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

```
In [1]: filename = 'huck_finn.txt'
```

```
In [2]: file = open(filename, mode='w') # 'w' is to write
```

```
In [3]: file.close()
```

Context manager with

```
In [1]: 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 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.

In the exercises, you'll:

- Print files to the console
- Print specific lines
- Discuss flat files



IMPORTING DATA IN PYTHON I

Let's practice!



IMPORTING DATA IN PYTHON I

The importance of flat files in data science



Flat files

titanic.csv

column

```
PassengerId,Survived,Pclass,Name,Gender,Age,SibSp,Parch,Ticket,Fa
re,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 (Florence Briggs
Thayer)",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
```

row

	Name	Gender	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



Flat files

- Text files containing records
- That is, table data
- Record: row of fields or attributes
- Column: feature or attribute

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 (Florence Briggs Thayer)",female,38,1,0,PC 17599,71.2833,C85,C
```



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
2,1,1,"Cumings, Mrs. John Bradley (Florence Briggs Thayer)",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
4,1,1,"Futrelle, Mrs. Jacques Heath (Lily May Peel)",female,
35,1,0,113803,53.1,C123,S
5,0,3,"Allen, Mr. William Henry",male,35,0,0,373450,8.05,,S
6,0,3,"Moran, Mr. James",male,,0,0,330877,8.4583,,Q
7,0,1,"McCarthy, Mr. Timothy J",male,54,0,0,17463,51.8625,E46,S
8,0,3,"Palsson, Master. Gosta Leonard",male,2,3,1,349909,21.075,,S
9,1,3,"Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)",female,
27,0,2,347742,11.1333,,S
```

File extension

- .csv - Comma separated values
- .txt - Text file
- commas, tabs - Delimiters

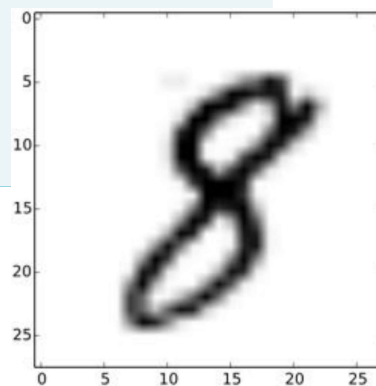


Tab-delimited file

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	5	165	254
0	0	0	0	0
0	0	0	0	0
0	0	0	0	41
253	253	253	253	253

MNIST
image





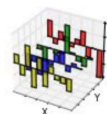
How do you import flat files?

- Two main packages: NumPy, pandas



pandas

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



- Here, you'll learn to import:
 - Flat files with numerical data (MNIST)
 - Flat files with numerical data and strings (titanic.csv)



IMPORTING DATA IN PYTHON I

Let's practice!



IMPORTING DATA IN PYTHON I

Importing flat files using NumPy



Why NumPy?

- NumPy arrays: standard for storing numerical data
- Essential for other packages: e.g. scikit-learn



- `loadtxt()`
- `genfromtxt()`



Importing flat files using NumPy

```
In [1]: import numpy as np
```

```
In [2]: filename = 'MNIST.txt'
```

```
In [3]: data = np.loadtxt(filename, delimiter=',')
```

```
In [4]: data
```

```
Out[4]:
```

```
[[ 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

```
In [1]: import numpy as np
```

```
In [2]: filename = 'MNIST_header.txt'
```

```
In [3]: data = np.loadtxt(filename, delimiter=',',  
skiprows=1)
```

```
In [4]: 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.]
```

Customizing your NumPy import

```
In [1]: import numpy as np
```

```
In [2]: filename = 'MNIST_header.txt'
```

```
In [3]: data = np.loadtxt(filename, delimiter=',', skiprows=1,  
usecols=[0, 2])
```

```
In [4]: print(data)
```

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

Customizing your NumPy import

```
In [1]: data = np.loadtxt(filename, delimiter=',',  
dtype=str)
```




Mixed datatypes

titanic.csv

Name	Gender	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



IMPORTING DATA IN PYTHON I

Let's practice!



IMPORTING DATA IN PYTHON I

Importing flat files using pandas



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

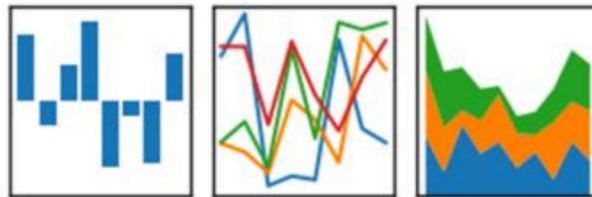
Pandas and the DataFrame



Wes McKinney

pandas

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



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



Following

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

```
In [1]: import pandas as pd
```

```
In [2]: filename = 'winequality-red.csv'
```

```
In [3]: data = pd.read_csv(filename)
```

```
In [4]: data.head()
```

```
Out[4]:
```

	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

```
In [5]: data_array = data.values
```

You'll experience:

- Importing flat files in a straightforward manner
- Importing flat files with issues such as comments and missing values



IMPORTING DATA IN PYTHON I

Let's practice!



IMPORTING DATA IN PYTHON I

Final thoughts on data import



Next chapters:

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



Wes McKinney
@wesmckinn



Following

Announcing Feather: A fast, language-agnostic data frame file format, by [@hadleywickham](#) and [@wesmckinn](#)

- Interact with relational databases



Next course:

- Scrape data from the web
- Interact with APIs



IMPORTING DATA IN PYTHON I

Congratulations!