

# Welcome to the course!

INTRODUCTION TO IMPORTING DATA IN PYTHON



**Hugo Bowne-Anderson**  
Data Scientist at DataCamp

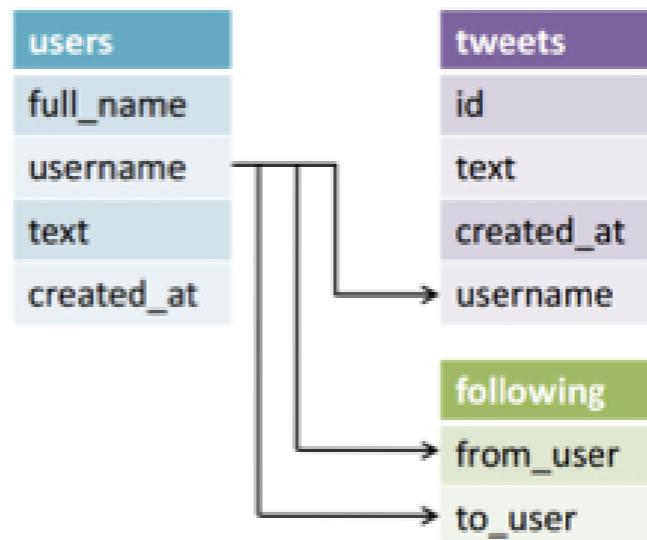
# Import data

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

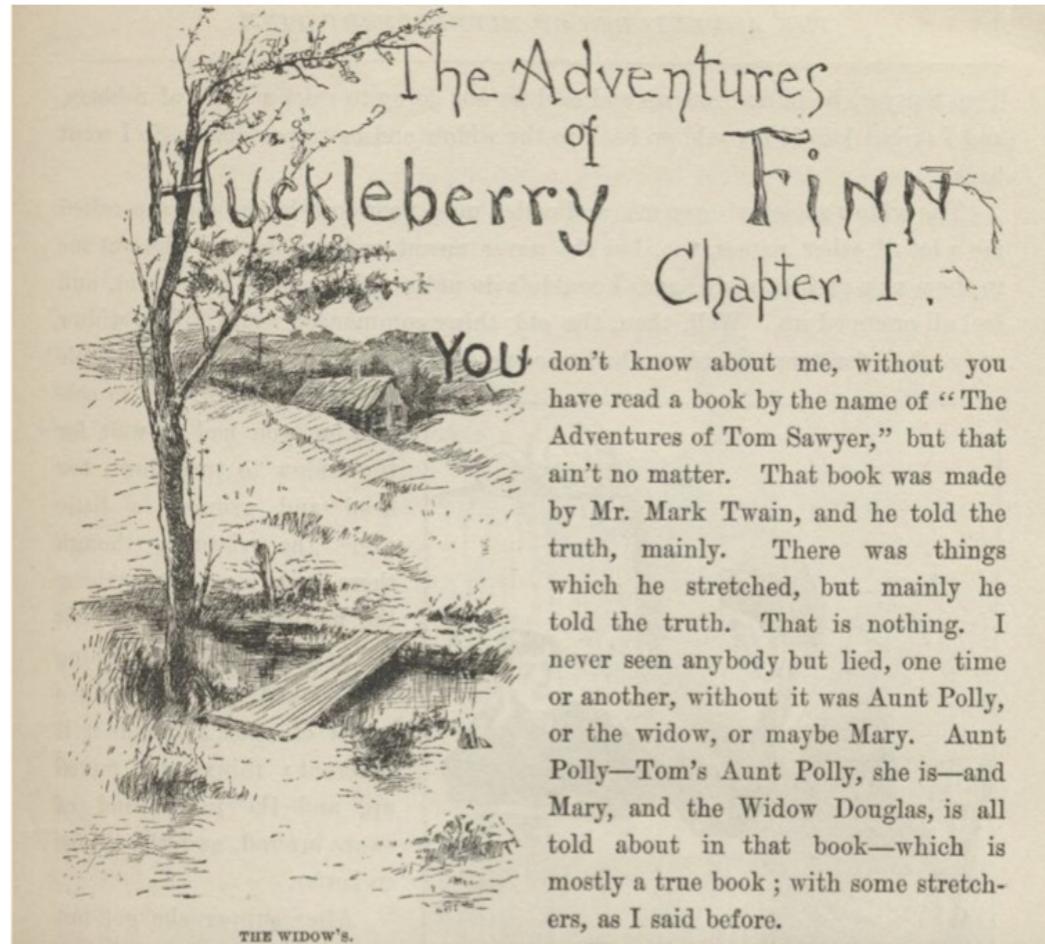


# Import data

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



# Plain text files



Source: Project Gutenberg

# Table data

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	
Futrelle, Mrs. Jacques Heath	female	C123	1	
Allen, Mr. William Henry	male	NaN	0	

<sup>1</sup> Source: Kaggle

# Table data

titanic.csv

Name	Sex	Cabin	Survived	
Braund, Mr. Owen Harris	male	NaN	0	<-- row
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	

# 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
Futrelle, Mrs. Jacques Heath	female	C123	1
Allen, Mr. William Henry	male	NaN	0

^column

- Flat file

# Reading a text file

```
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

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

# Context manager with

```
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

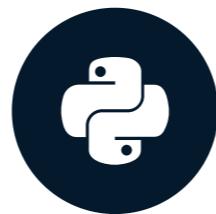
# **Let's practice!**

**INTRODUCTION TO IMPORTING DATA IN PYTHON**

# The importance of flat files in data science

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# 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

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



	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
Allison, Mr. William Henry		male	NaN	0

# 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           <-- row
```

```
-----  
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
```



	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

# Flat files

titanic.csv

column

```
PassengerId,Survived,Pclass, | Name | ,Gender,Age,SibSp,Parch,Ticket,Fare,Cabin,Embar  
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
```



	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

# Flat files

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

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

- 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          <-- row
-----
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

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

titanic.csv

```
column
PassengerId,Survived,Pclass, | Name | ,Gender,Age,SibSp,Parch,Ticket,Fare,Cabin,Embar
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
```

# 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",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
```

# 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",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

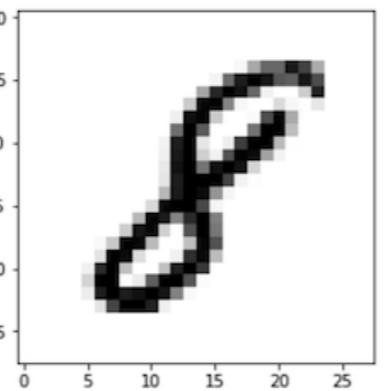
pixel149	pixel150	pixel151	pixel152	pixel153
0	0	0	0	0
86	250	254	254	254
0	0	0	9	254
0	0	0	0	0
103	253	253	253	253
0	0	0	0	0
0	0	0	0	0
0	0	0	0	41
253	253	253	253	253

# Tab-delimited file

MNIST.txt

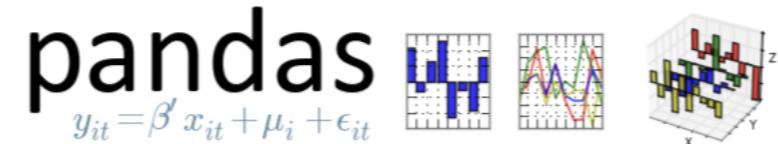
pixel149	pixel150	pixel151	pixel152	pixel153
0	0	0	0	0
86	250	254	254	254
0	0	0	9	254
0	0	0	0	0
103	253	253	253	253
0	0	0	0	0
0	0	0	0	0
0	0	0	0	41
253	253	253	253	253

MNIST image:



# How do you import flat files?

- Two main packages: NumPy, pandas



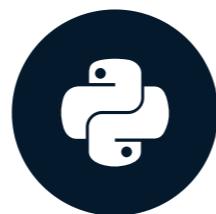
- Here, you'll learn to import:
  - Flat files with numerical data (MNIST)
  - Flat files with numerical data and strings (titanic.csv)

# **Let's practice!**

**INTRODUCTION TO IMPORTING DATA IN PYTHON**

# 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

```
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

```
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.]]
```

# Customizing your NumPy import

```
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.]]
```

# Customizing your NumPy import

```
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	

<sup>1</sup> 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

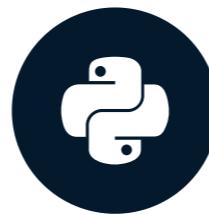
<sup>1</sup> Source: Kaggle

# **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



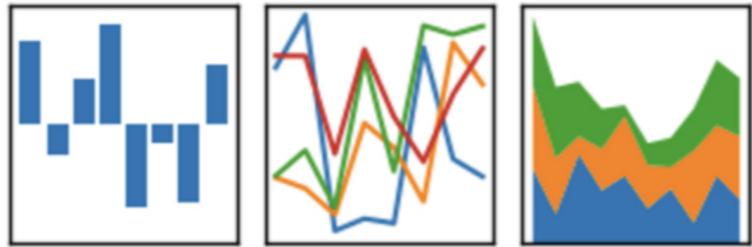
Wes McKinney

# Pandas and the DataFrame



pandas

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



Wes McKinney

# 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

```
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
```

```
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

# **Let's practice!**

**INTRODUCTION TO IMPORTING DATA IN PYTHON**

# Final thoughts on data import

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# 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

# **Let's practice!**

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