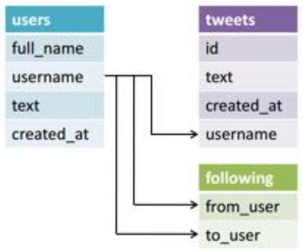
IMPORTING DATA IN PYTHON I

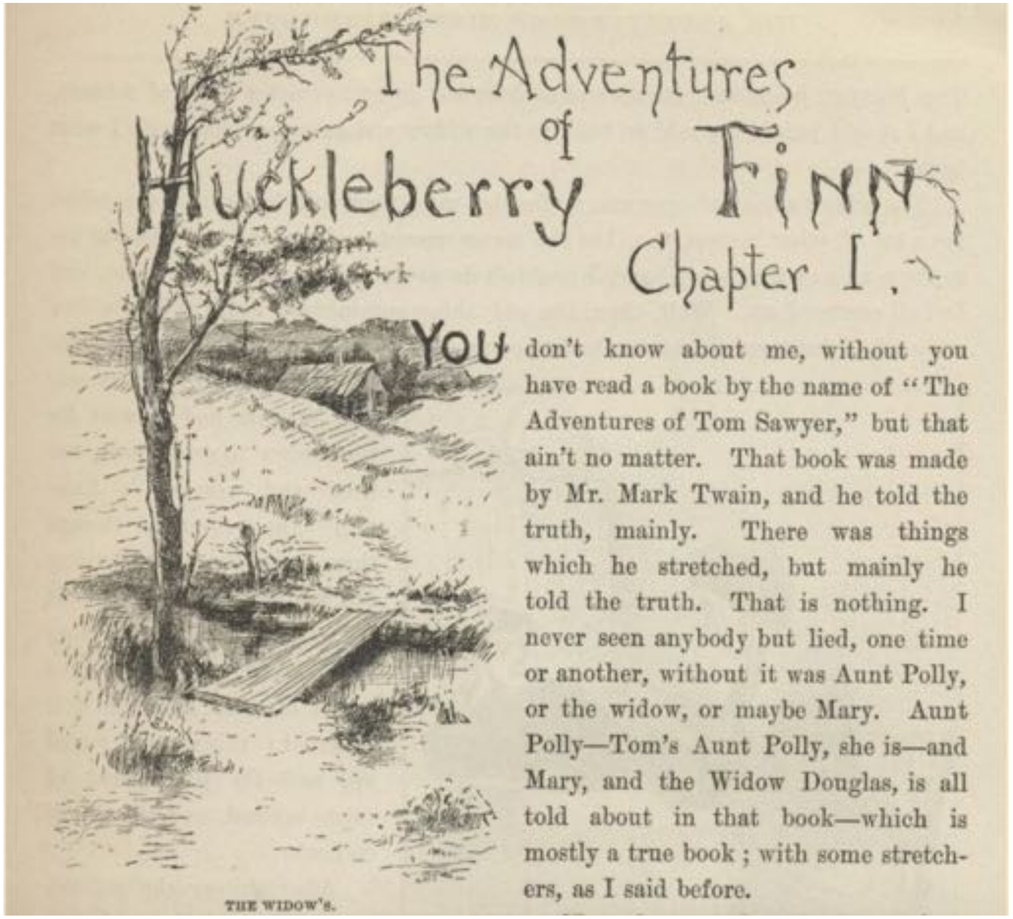
Welcome to the course!

Import data

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



Plain text files



The Adventures of Huckleberry Finn

Chapter I.

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. I 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.

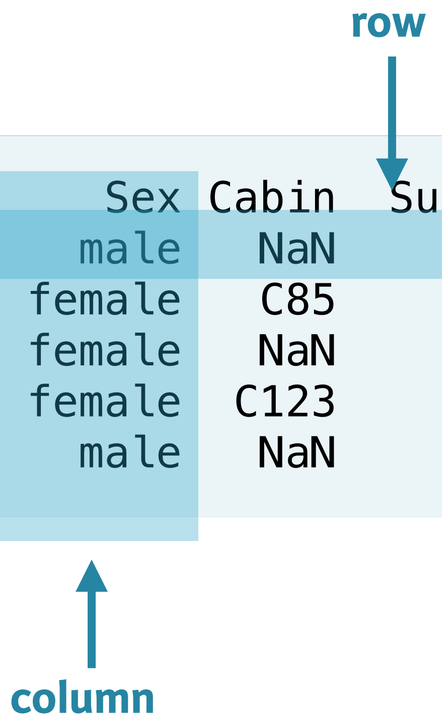
THE WIDOW'S.

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



- Flat file

Source: Kaggle

Reading a text file

Code——1

```
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

Code_2

```
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

Code_3

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

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

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

Context manager `with`

Code_4

```
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

column

titanic.csv

```
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

每一条record都等于一行

titanic.csv

```
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
```

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

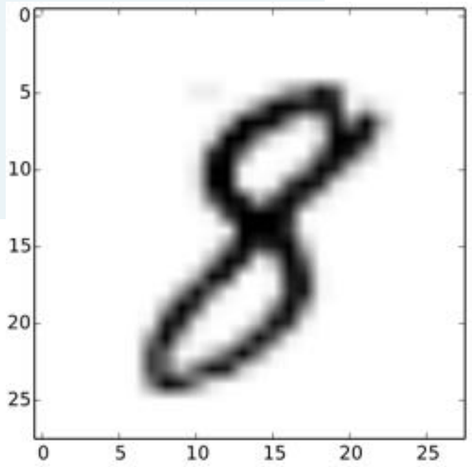
- .csv - Comma separated values
- .txt - Text file
- commas, tabs - Delimiters

Tab-delimited file

MNIST.txt

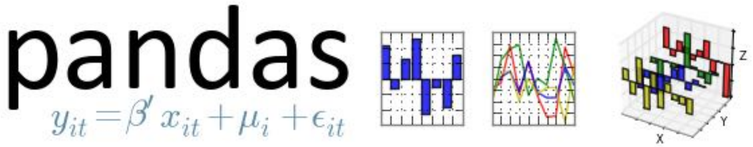
```
pixel149  pixel150  pixel151  pixel152  pixel153
0         0         0         0         0
86        250       254       254       254
0         0         0         9         254
0         0         0         0         0
103       253       253       253       253
0         0         5         165       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



Numpy array. Or pandas dataframe

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

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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

Code_5

```
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

Code_6

```
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.]]
```

skiprows

Customizing your NumPy import

Code_7

```
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.]]
```

采集第一列和第三列的数据

Customizing your NumPy import

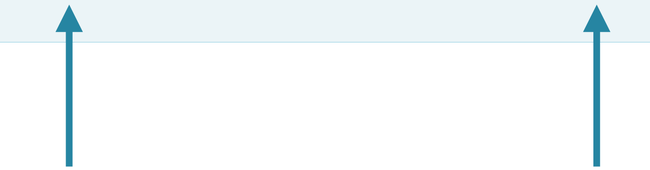
Code_8

```
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



Source: Kaggle

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Let’s practice!

IMPORTING DATA IN PYTHON I

Importing flat files using pandas

What a data scientist needs

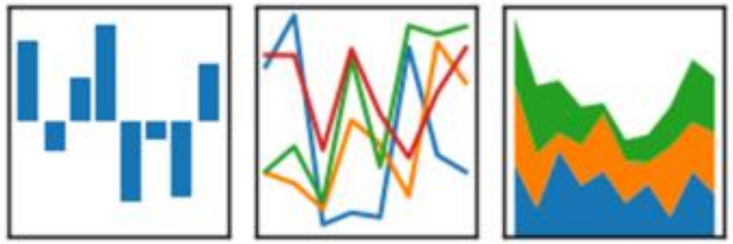
- Two-dimensional labeled data structure(s)
- Columns of potentially different types
- Manipulate, slice, reshape, groupby, join, merge
- Perform statistics
- Work with time series data

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

Manipulating pandas DataFrames

- Exploratory data analysis
- Data wrangling
- Data preprocessing
- Building models
- Visualization

- Standard and best practice to use pandas

Importing using pandas

Code_9

```
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

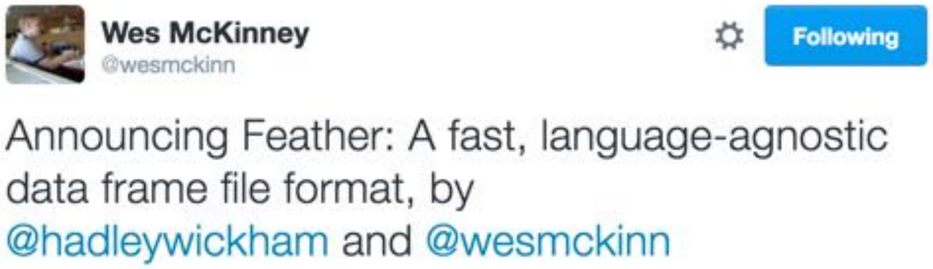
Let’s practice!

IMPORTING DATA IN PYTHON I

Final thoughts on data import

Next chapters:

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



- Interact with relational databases

Next course:

- Scrape data from the web
- Interact with APIs

IMPORTING DATA IN PYTHON I

Congratulations!