Welcome to the course!

INTRODUCTION TO IMPORTING DATA IN PYTHON

Hugo Bowne-Anderson
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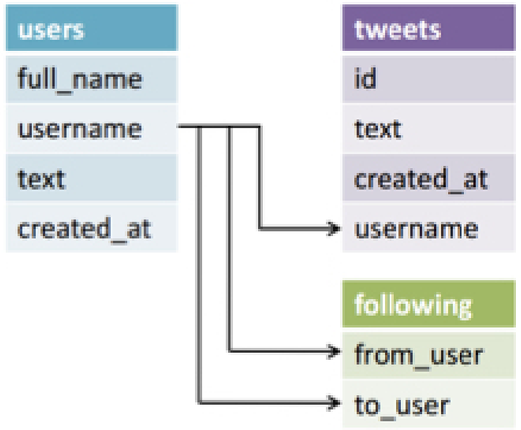
Import data

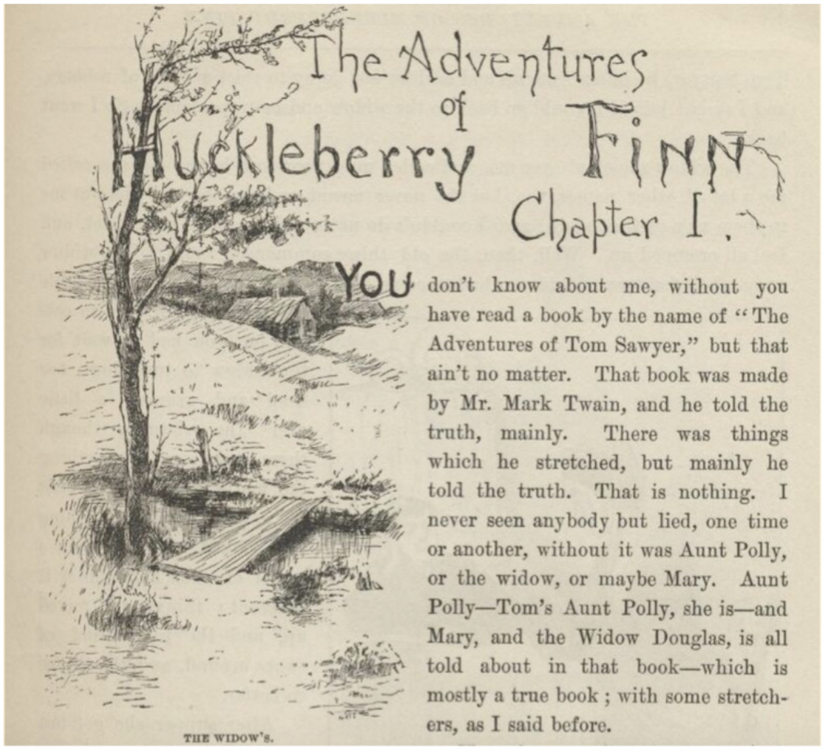
- Flat files, e.g. .txts, .csvs
- Files from other software

Import data

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



Plain text files



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

[1] Source: Kaggle

Table data

`titanic.csv`

Name	Sex	Cabin	Survived
Braund, Mr. Owen Harris	male	NaN	0
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Table data

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Allen, Mr. William Henry	male	NaN	0

- 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
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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
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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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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

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```

Name	Sex	Cabin	Survived
Braund, Mr. Owen Harris	male	NaN	0
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Heikkinen, Miss. Laina	female	NaN	1
Futrelle, Mrs. Jacques Heath	female	C123	1

Flat files

`titanic.csv`

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```

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Flat files

`titanic.csv`

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

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3,1,3,"Heikkinen, Miss. Laina",female,26,0,0,STON/O2.3101282,7.925,,S
```

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

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
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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`

```
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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- Record: row of fields or attributes
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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
2,1,1,"Cumings, Mrs. John Bradley",female,38,1,0,PC 17599,71.2833,C85,C
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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
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`

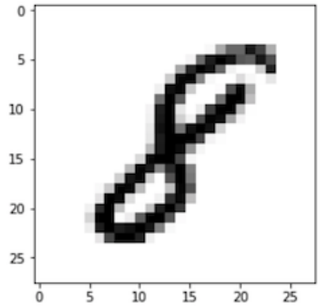
```
pixel149    pixel150    pixel151    pixel152    pixel153
0           0           0           0           0
86          250         254         254         254
0           0           0           9           254
0           0           0           0           0
103         253         253        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

```
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.]]
```

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

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.]]
```

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

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

[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
```

[1] Source: Kaggle

Let's practice!

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Importing flat files using pandas

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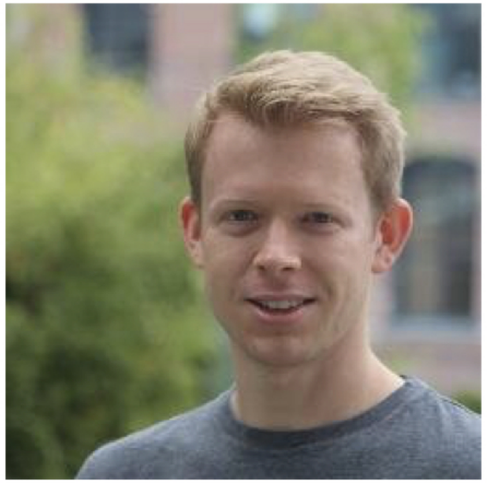
What a data scientist needs

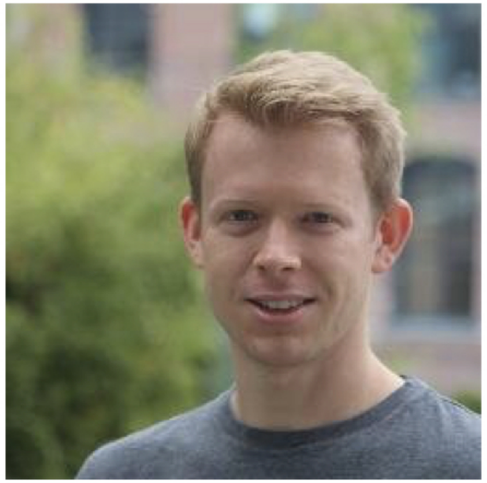
- Two-dimensional labeled data structure(s)
- Columns of potentially different types
- Manipulate, slice, reshape, groupby, join, merge
- Perform statistics
- Work with time series data

Pandas and the DataFrame



Wes McKinney

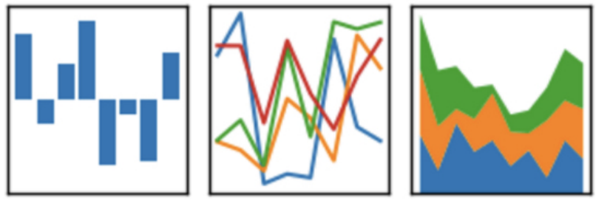
Pandas and the DataFrame



Wes McKinney

pandas

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



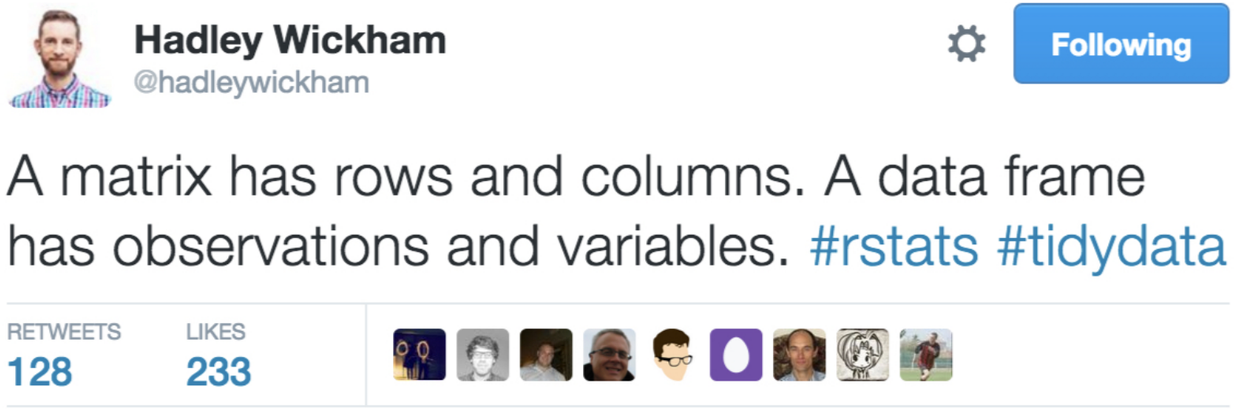
Pandas and the DataFrame

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

```
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.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!

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