Welcome to the course!

INTRODUCTION TO IMPORTING DATA IN PYTHON

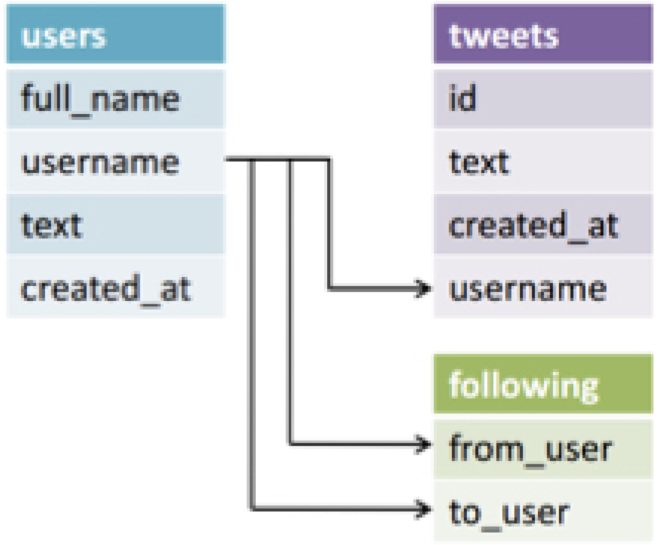
Hugo Bowne-Anderson
Data Scientist at DataCamp

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

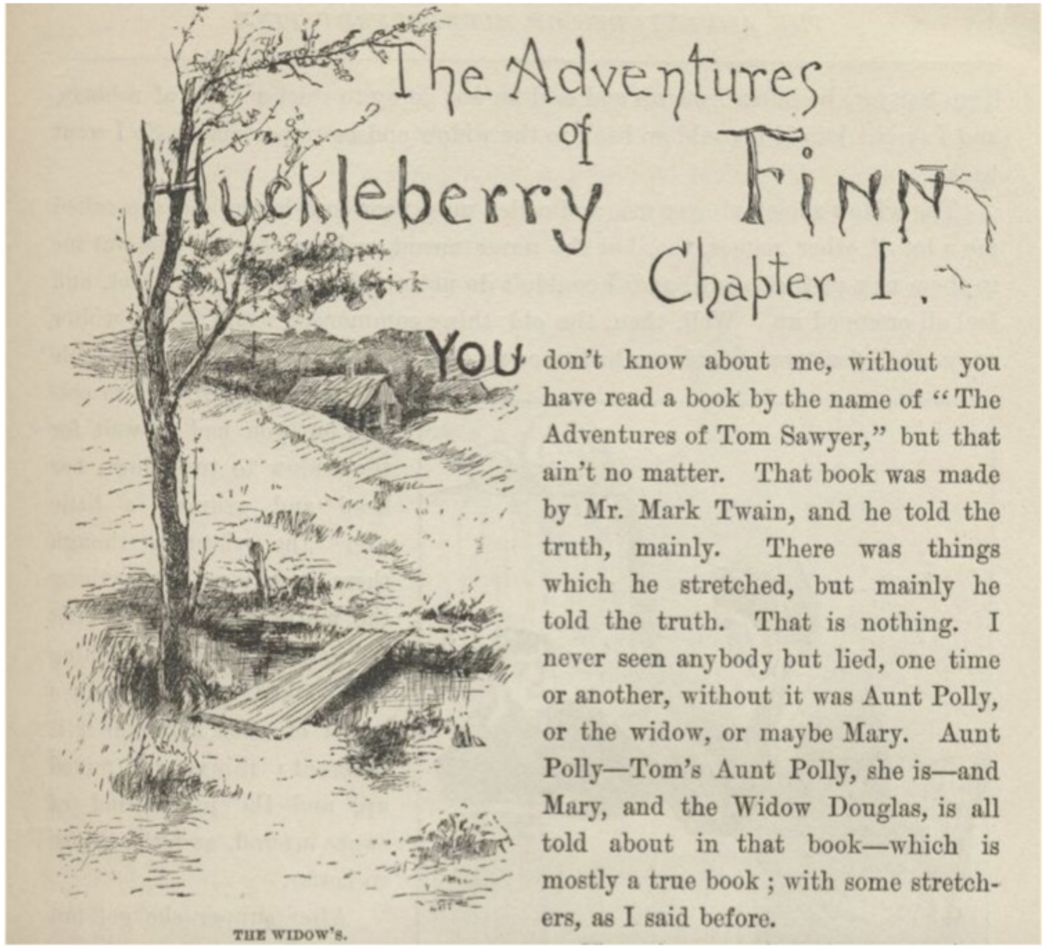


users
full_name
username
text
created_at

tweets
id
text
created_at
username

following
from_user
to_user

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

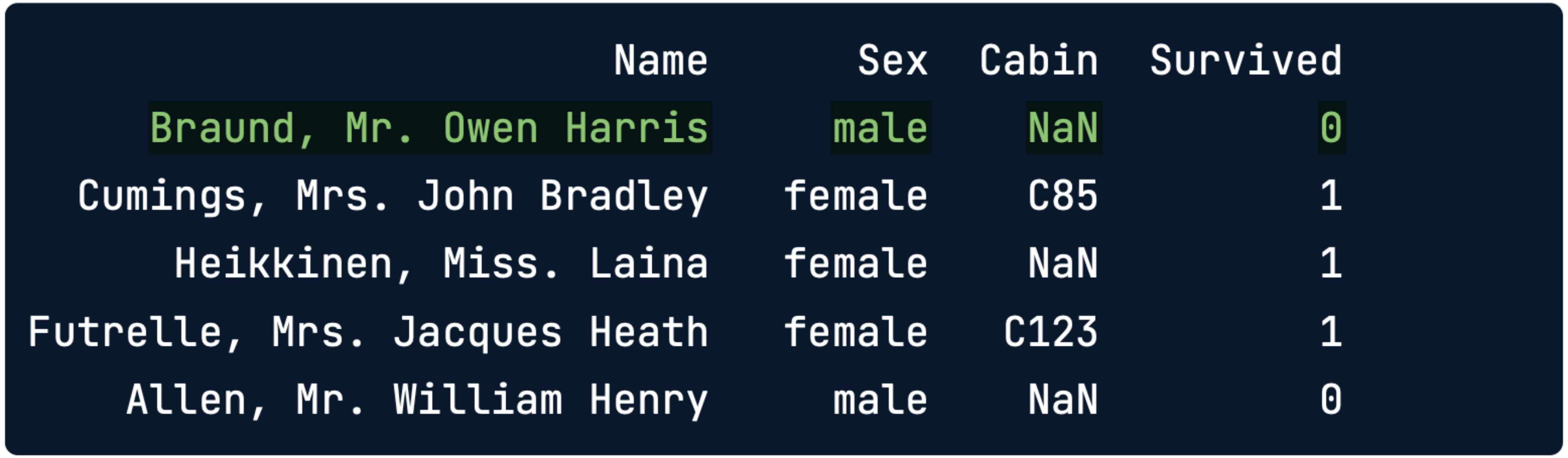
`titanic.csv`

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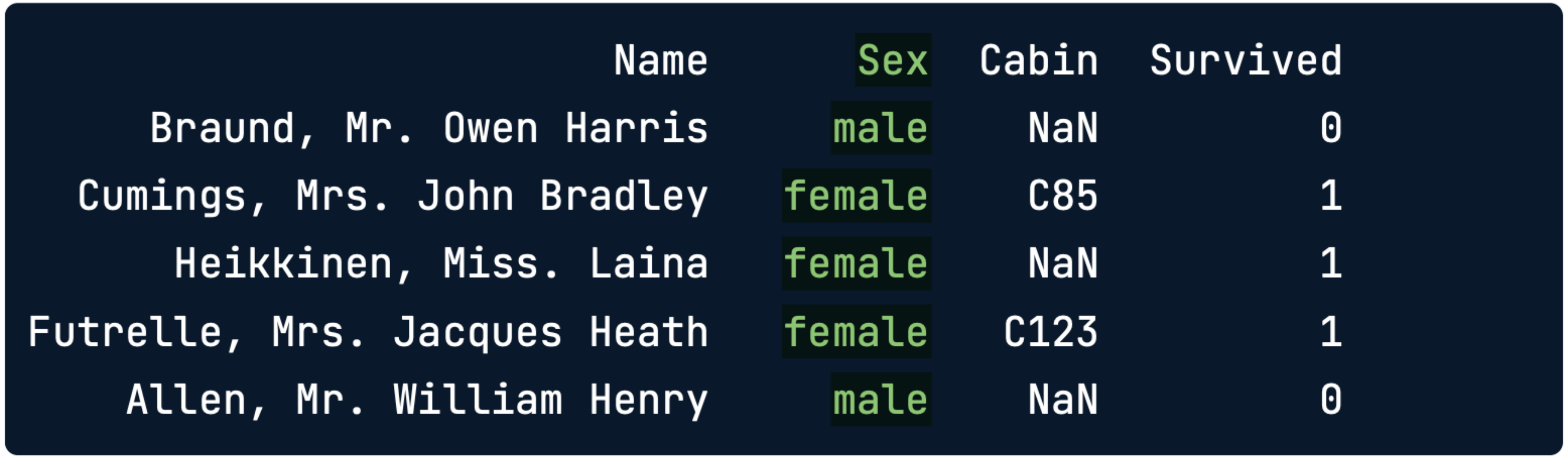
Table data

`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

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

```python
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

```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
he stretched, but mainly he told the truth.  That is
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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

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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`

```
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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```

Flat files

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```

↓

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

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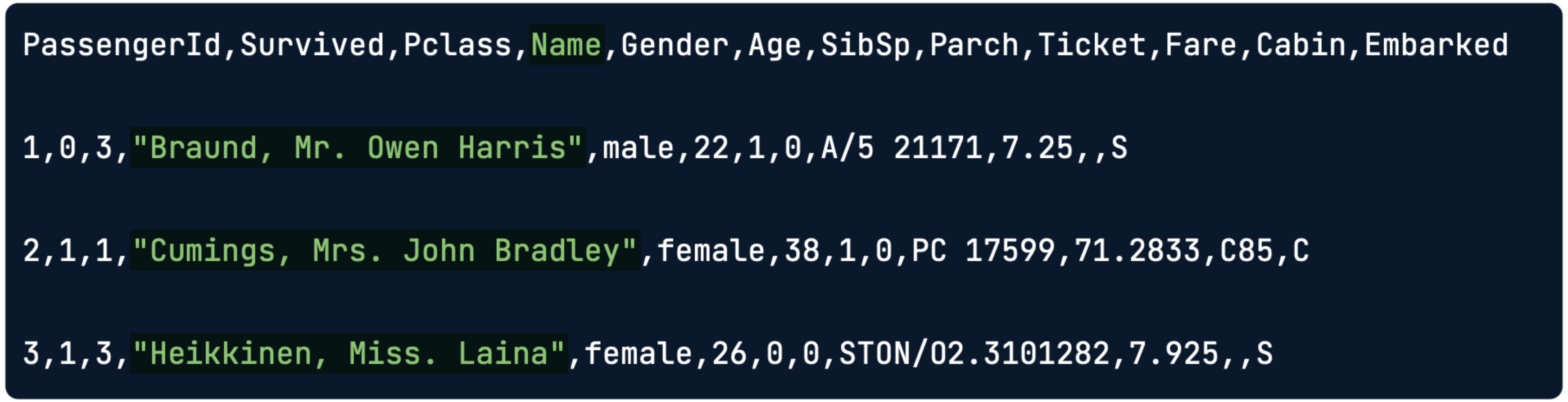
```

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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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
------------------------------------------------------------------------
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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`

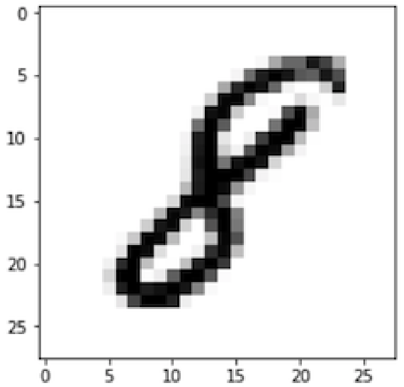
```
pixel149    pixel150    pixel151    pixel152    pixel153
0           0           0           0           0
86          250         254         254         254
0           0           0           9           254
0           0           0           0           0
103         253         253        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

```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

```
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!

Importing flat files using pandas

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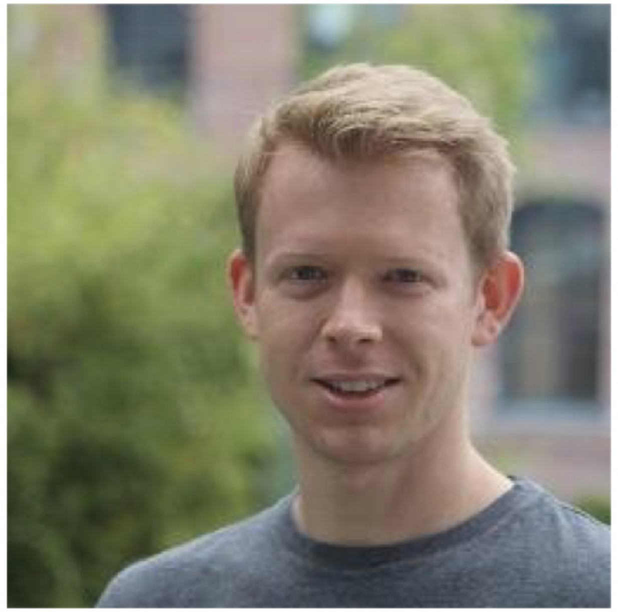
What a data scientist needs

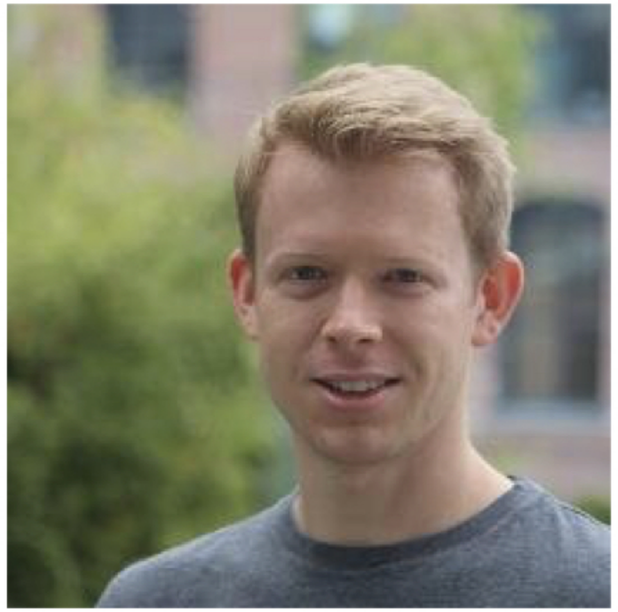
- Two-dimensional labeled data structure(s)
- Columns of potentially different types
- Manipulate, slice, reshape, groupby, join, merge
- Perform statistics
- Work with time series data

Pandas and the DataFrame



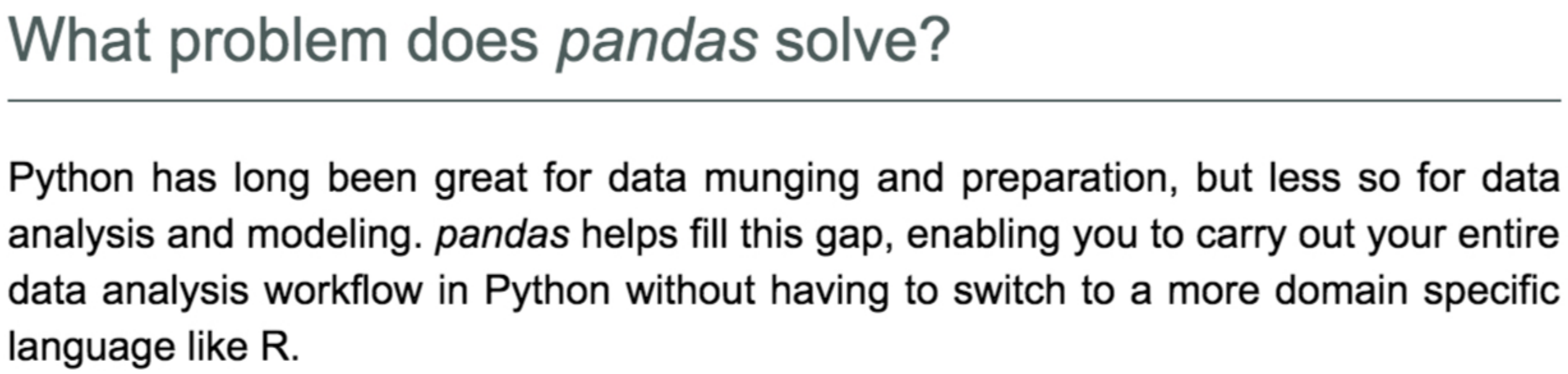
Wes McKinney

Pandas and the DataFrame



Wes McKinney

Pandas and the DataFrame

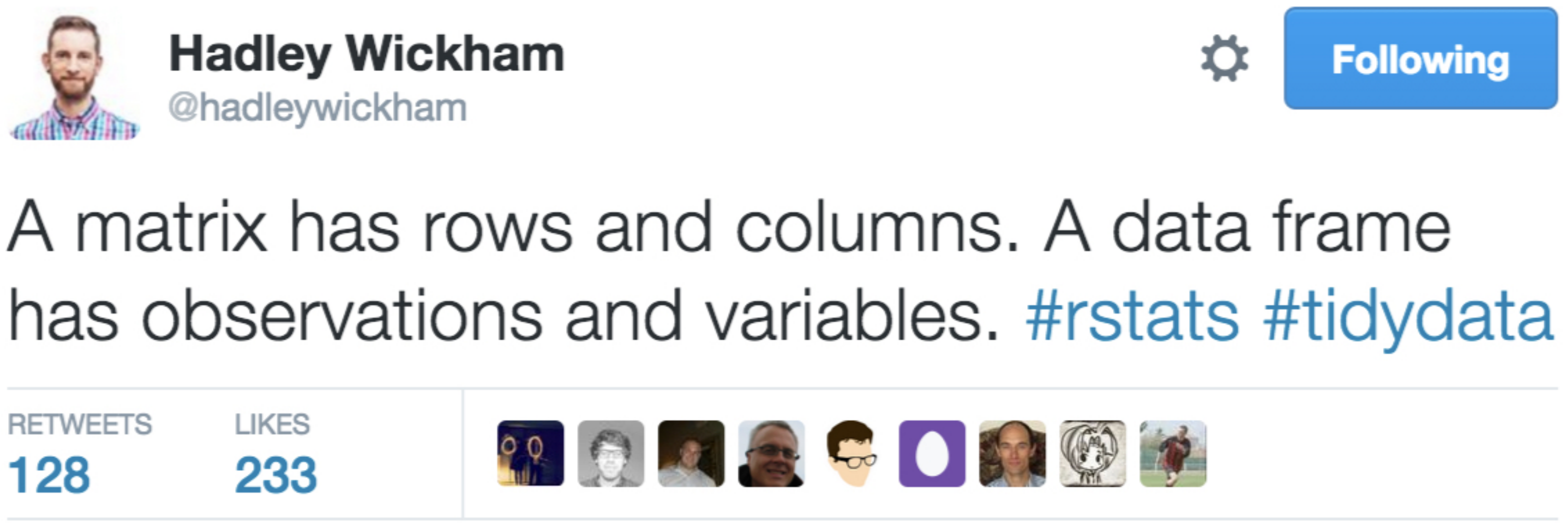


What problem does *pandas* solve?

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

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!

INTRODUCTION TO IMPORTING DATA IN PYTHON

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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