Introducing DataFrames

DATA MANIPULATION WITH PANDAS

Richie Cotton

Learning Solutions Architect at DataCamp

datacamp

What's the point of pandas?

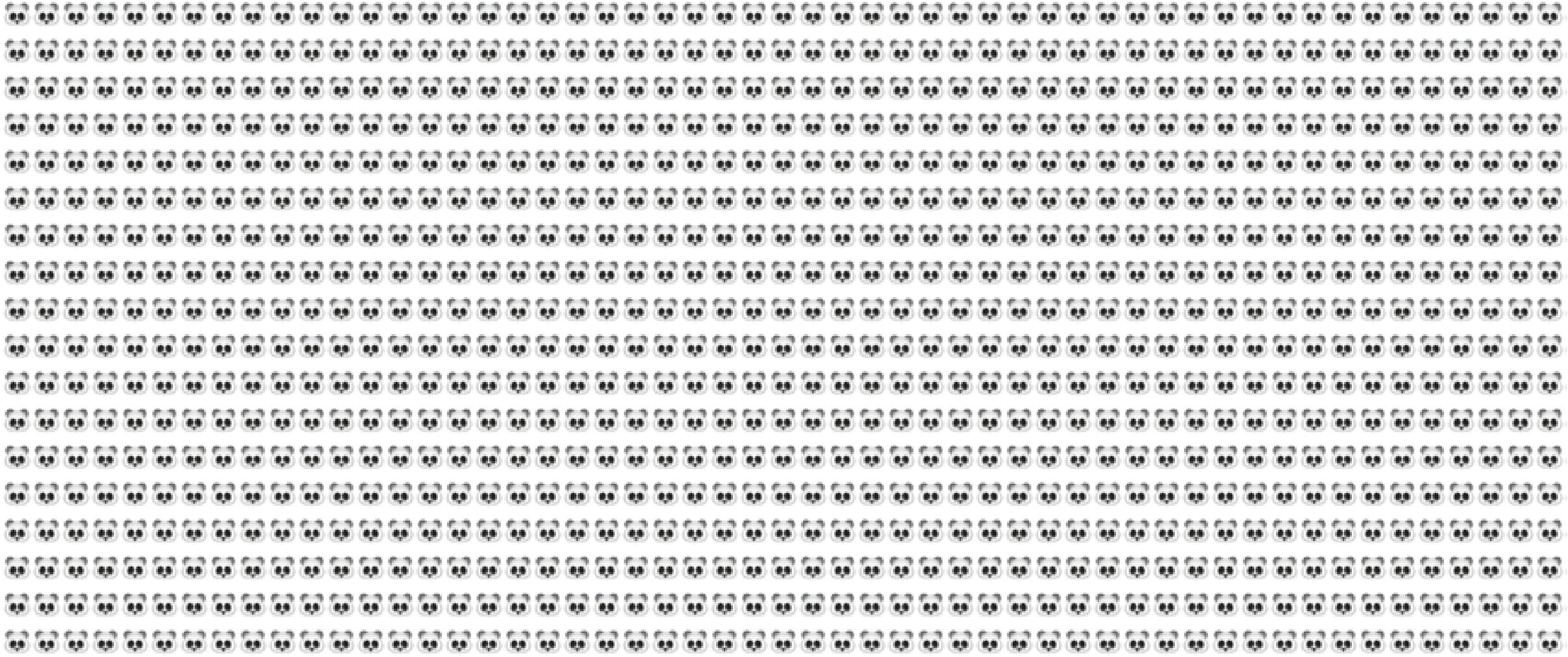
- Data Manipulation skill track
- Data Visualization skill track

Course outline

- **Chapter 1: DataFrames**
  - Sorting and subsetting
  - Creating new columns
- **Chapter 2: Aggregating Data**
  - Summary statistics
  - Counting
  - Grouped summary statistics
- **Chapter 3: Slicing and Indexing Data**
  - Subsetting using slicing
  - Indexes and subsetting using indexes
- **Chapter 4: Creating and Visualizing Data**
  - Plotting
  - Handling missing data
  - Reading data into a DataFrame

pandas is built on NumPy and Matplotlib

pandas is popular



[1] https://pypistats.org/packages/pandas

Rectangular data

Name	Breed	Color	Height (cm)	Weight (kg)	Date of Birth
Bella	Labrador	Brown	56	25	2013-07-01
Charlie	Poodle	Black	43	23	2016-09-16
Lucy	Chow Chow	Brown	46	22	2014-08-25
Cooper	Schnauzer	Gray	49	17	2011-12-11
Max	Labrador	Black	59	29	2017-01-20
Stella	Chihuahua	Tan	18	2	2015-04-20
Bernie	St. Bernard	White	77	74	2018-02-27

pandas DataFrames

```
print(dogs)
```

```
      name         breed  color  height_cm  weight_kg date_of_birth
0    Bella      Labrador  Brown         56         24    2013-07-01
1  Charlie        Poodle  Black         43         24    2016-09-16
2     Lucy     Chow Chow  Brown         46         24    2014-08-25
3   Cooper     Schnauzer   Gray         49         17    2011-12-11
4      Max      Labrador  Black         59         29    2017-01-20
5   Stella     Chihuahua    Tan         18          2    2015-04-20
6   Bernie  St. Bernard  White         77         74    2018-02-27
```

Exploring a DataFrame: .head()

.head() returns the first few rows (the “head” of the DataFrame).

```
dogs.head()
```

```
     name          breed  color  height_cm  weight_kg date_of_birth
0    Bella       Labrador  Brown         56         24    2013-07-01
1  Charlie         Poodle  Black         43         24    2016-09-16
2     Lucy     Chow Chow  Brown         46         24    2014-08-25
3   Cooper     Schnauzer   Gray         49         17    2011-12-11
4      Max       Labrador  Black         59         29    2017-01-20
```

Exploring a DataFrame: .info()

```
dogs.info()
```

.info() shows information on each of the columns, such as the data type and number of missing values.

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7 entries, 0 to 6
Data columns (total 6 columns):
name              7 non-null object
breed             7 non-null object
color             7 non-null object
height_cm         7 non-null int64
weight_kg         7 non-null int64
date_of_birth     7 non-null object
dtypes: int64(2), object(4)
memory usage: 464.0+ bytes
```

Exploring a DataFrame: .shape

```
dogs.shape
```

```
(7, 6)
```

.shape returns the number of rows and columns of the DataFrame.

Exploring a DataFrame: .describe()

.describe() calculates a few summary statistics for each column.

```
dogs.describe()
```

```
       height_cm  weight_kg
count   7.000000   7.000000
mean   49.714286  27.428571
std    17.960274  22.292429
min    18.000000   2.000000
25%    44.500000  19.500000
50%    49.000000  23.000000
75%    57.500000  27.000000
max    77.000000  74.000000
```

Components of a DataFrame: .values

```
dogs.values
```

.values: A two-dimensional NumPy array of values.

```
array([['Bella', 'Labrador', 'Brown', 56, 24, '2013-07-
       ['Charlie', 'Poodle', 'Black', 43, 24, '2016-09-16'],
       ['Lucy', 'Chow Chow', 'Brown', 46, 24, '2014-08-25'],
       ['Cooper', 'Schnauzer', 'Gray', 49, 17, '2011-12-11'],
       ['Max', 'Labrador', 'Black', 59, 29, '2017-01-20'],
       ['Stella', 'Chihuahua', 'Tan', 18, 2, '2015-04-20'],
       ['Bernie', 'St. Bernard', 'White', 77, 74, '2018-02-27']],
      dtype=object)
```

Components of a DataFrame: .columns and .index

```
dogs.columns
```

.columns: An index of columns: the column names.

```
Index(['name', 'breed', 'color', 'height_cm', 'weight_kg', 'date_of_birth'],
dtype='object')
```

```
dogs.index
```

.index: An index for the rows: either row numbers or row names.

```
RangeIndex(start=0, stop=7, step=1)
```

pandas Philosophy

> There should be one -- and preferably only one -- obvious way to do it.

- *The Zen of Python* by Tim Peters, Item 13

[1] https://www.python.org/dev/peps/pep-0020/

Let's practice!

DATA MANIPULATION WITH PANDAS

Sorting and subsetting

DATA MANIPULATION WITH PANDAS

Richie Cotton

Learning Solutions Architect at DataCamp

datacamp

Sorting

```
dogs.sort_values("weight_kg")
```

	name	breed	color	height_cm	weight_kg	date_of_birth
5	Stella	Chihuahua	Tan	18	2	2015-04-20
3	Cooper	Schnauzer	Gray	49	17	2011-12-11
0	Bella	Labrador	Brown	56	24	2013-07-01
1	Charlie	Poodle	Black	43	24	2016-09-16
2	Lucy	Chow Chow	Brown	46	24	2014-08-25
4	Max	Labrador	Black	59	29	2017-01-20
6	Bernie	St. Bernard	White	77	74	2018-02-27

Sorting in descending order

```
dogs.sort_values("weight_kg", ascending=False)
```

	name	breed	color	height_cm	weight_kg	date_of_birth
6	Bernie	St. Bernard	White	77	74	2018-02-27
4	Max	Labrador	Black	59	29	2017-01-20
0	Bella	Labrador	Brown	56	24	2013-07-01
1	Charlie	Poodle	Black	43	24	2016-09-16
2	Lucy	Chow Chow	Brown	46	24	2014-08-25
3	Cooper	Schnauzer	Gray	49	17	2011-12-11
5	Stella	Chihuahua	Tan	18	2	2015-04-20

Sorting by multiple variables

```
dogs.sort_values(["weight_kg", "height_cm"])
```

	name	breed	color	height_cm	weight_kg	date_of_birth
5	Stella	Chihuahua	Tan	18	2	2015-04-20
3	Cooper	Schnauzer	Gray	49	17	2011-12-11
1	Charlie	Poodle	Black	43	24	2016-09-16
2	Lucy	Chow Chow	Brown	46	24	2014-08-25
0	Bella	Labrador	Brown	56	24	2013-07-01
4	Max	Labrador	Black	59	29	2017-01-20
6	Bernie	St. Bernard	White	77	74	2018-02-27

Sorting by multiple variables

```
dogs.sort_values(["weight_kg", "height_cm"], ascending=[True, False])
```

	name	breed	color	height_cm	weight_kg	date_of_birth
5	Stella	Chihuahua	Tan	18	2	2015-04-20
3	Cooper	Schnauzer	Gray	49	17	2011-12-11
0	Bella	Labrador	Brown	56	24	2013-07-01
2	Lucy	Chow Chow	Brown	46	24	2014-08-25
1	Charlie	Poodle	Black	43	24	2016-09-16
4	Max	Labrador	Black	59	29	2017-01-20
6	Bernie	St. Bernard	White	77	74	2018-02-27

Subsetting columns

When working with data, you may not need all of the variables in your dataset. Square brackets ([]) can be used to select only the columns that matter to you in an order that makes sense to you.

```
dogs["name"]
```

```
0      Bella
1    Charlie
2       Lucy
3     Cooper
4        Max
5     Stella
6     Bernie
Name: name, dtype: object
```

Subsetting multiple columns

```
dogs[["breed", "height_cm"]]
```

```
          breed  height_cm
0      Labrador         56
1        Poodle         43
2     Chow Chow         46
3     Schnauzer         49
4      Labrador         59
5     Chihuahua         18
6  St. Bernard         77
```

```
cols_to_subset = ["breed", "height_cm"]
dogs[cols_to_subset]
```

```
          breed  height_cm
0      Labrador         56
1        Poodle         43
2     Chow Chow         46
3     Schnauzer         49
4      Labrador         59
5     Chihuahua         18
6  St. Bernard         77
```

Subsetting rows

```
dogs["height_cm"] > 50
```

```
0     True
1    False
2    False
3    False
4     True
5    False
6     True
Name: height_cm, dtype: bool
```

Subsetting rows

```
dogs[dogs["height_cm"] > 50]
```

```
     name         breed  color  height_cm  weight_kg date_of_birth
0   Bella      Labrador  Brown         56         24    2013-07-01
4     Max      Labrador  Black         59         29    2017-01-20
6  Bernie  St. Bernard  White         77         74    2018-02-27
```

Subsetting based on text data

```
dogs[dogs["breed"] == "Labrador"]
```

```
    name         breed  color  height_cm  weight_kg date_of_birth
0   Bella      Labrador  Brown         56         24    2013-07-01
4     Max      Labrador  Black         59         29    2017-01-20
```

Subsetting based on dates

```
dogs[dogs["date_of_birth"] > "2015-01-01"]
```

	name	breed	color	height_cm	weight_kg	date_of_birth
1	Charlie	Poodle	Black	43	24	2016-09-16
4	Max	Labrador	Black	59	29	2017-01-20
5	Stella	Chihuahua	Tan	18	2	2015-04-20
6	Bernie	St. Bernard	White	77	74	2018-02-27

Subsetting based on multiple conditions

```
is_lab = dogs["breed"] == "Labrador"
is_brown = dogs["color"] == "Brown"
dogs[is_lab & is_brown]
```

```
     name         breed  color  height_cm  weight_kg date_of_birth
0   Bella      Labrador  Brown         56         24    2013-07-01
```

```
dogs[ (dogs["breed"] == "Labrador") & (dogs["color"] == "Brown") ]
```

You can filter for multiple conditions at once by using the "bitwise and" operator, &.

Subsetting using .isin()

```
is_black_or_brown = dogs["color"].isin(["Black", "Brown"])
dogs[is_black_or_brown]
```

to select rows from multiple categories. Instead, use the .isin() method, which will allow you to tackle this problem by writing one condition instead of three separate ones.

	name	breed	color	height_cm	weight_kg	date_of_birth
0	Bella	Labrador	Brown	56	24	2013-07-01
1	Charlie	Poodle	Black	43	24	2016-09-16
2	Lucy	Chow Chow	Brown	46	24	2014-08-25
4	Max	Labrador	Black	59	29	2017-01-20

Let's practice!

DATA MANIPULATION WITH PANDAS

New columns

DATA MANIPULATION WITH PANDAS

Richie Cotton

Learning Solutions Architect at DataCamp

Adding a new column

```
dogs["height_m"] = dogs["height_cm"] / 100
print(dogs)
```

```
      name         breed  color  height_cm  weight_kg date_of_birth  height_m
0    Bella      Labrador  Brown         56         24    2013-07-01      0.56
1  Charlie        Poodle  Black         43         24    2016-09-16      0.43
2     Lucy     Chow Chow  Brown         46         24    2014-08-25      0.46
3   Cooper     Schnauzer   Gray         49         17    2011-12-11      0.49
4      Max      Labrador  Black         59         29    2017-01-20      0.59
5   Stella     Chihuahua    Tan         18          2    2015-04-20      0.18
6   Bernie  St. Bernard  White         77         74    2018-02-27      0.77
```

Doggy mass index

$$\text{BMI} = \text{weight in kg} / (\text{height in m})^2$$

```
dogs["bmi"] = dogs["weight_kg"] / dogs["height_m"] ** 2
print(dogs.head())
```

```
      name      breed  color  height_cm  weight_kg date_of_birth  height_m         bmi
0    Bella   Labrador  Brown         56         24    2013-07-01      0.56   76.530612
1  Charlie     Poodle  Black         43         24    2016-09-16      0.43  129.799892
2     Lucy  Chow Chow  Brown         46         24    2014-08-25      0.46  113.421550
3   Cooper  Schnauzer   Gray         49         17    2011-12-11      0.49   70.803832
4      Max   Labrador  Black         59         29    2017-01-20      0.59   83.309394
```

Multiple manipulations

```
bmi_lt_100 = dogs[dogs["bmi"] < 100]
bmi_lt_100_height  = bmi_lt_100.sort_values("height_cm", ascending=False)
bmi_lt_100_height[["name", "height_cm", "bmi"]]
```

```
     name  height_cm        bmi
4     Max         59  83.309394
0   Bella         56  76.530612
3  Cooper         49  70.803832
5  Stella         18  61.728395
```

Let's practice!

DATA MANIPULATION WITH PANDAS