Pandas_quick_tour

February 3, 2020

[1]:
```
# My standard magic !  You will see this in almost all my notebooks.

from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"

# Reload all modules imported with %aimport
%load_ext autoreload
%autoreload 1

%matplotlib inline
```

1 Pandas

VanderPlas Chapter 3, Geron notebook

[2]:
```
import numpy as np
import pandas as pd
```

1.1 Series

A Series is like a NumPy ndarray but with *symbolic indexing* (like a Dictionary)

[3]:
```
data = pd.Series([0.25, 0.5, 0.75, 1.0],
                 index=['a', 'b', 'c', 'd'])
data
```

[3]:
```
a    0.25
b    0.50
c    0.75
d    1.00
dtype: float64
```

You select elements by using members of the index

[4]:
```
print("data at 'b': ", data["b"])
```

```
data at 'b':  0.5
```

A Series looks a little like a Dictionary, but with useful operations like NumPy ndarrays

[5]:
```python
data.sum()
```

[5]:
```
2.5
```

You can access the index and the values directly. The values are a NumPy ndarray so you can easily integrate with NumPy.

The Index is it's own type.

[6]:
```python
data.index

data.values
type(data.values)
```

[6]:
```
Index(['a', 'b', 'c', 'd'], dtype='object')
```

[6]:
```
array([0.25, 0.5 , 0.75, 1.  ])
```

[6]:
```
numpy.ndarray
```

Symbolic indexing is super convenient ! No more "parallel" arrays of values and labels.

[7]:
```python
data = pd.Series( np.arange(0,3), index=["2018-01-01", "2018-01-02",␣
 ↪"2018-12-31"])
data.index
```

[7]:
```
Index(['2018-01-01', '2018-01-02', '2018-12-31'], dtype='object')
```

1.2 Pandas DataFrame

A DataFrame (note the capital "F") looks like a table or a 2-D ndarray but with *symbolic indexing* of rows and columns.

Unlike an ndarray, the columns can be different types.

1.2.1 Constructor

There are several ways to construct a DataFrame. Common methods: - list of tuples, each tuple representing a row - list of Dictionaries, each Dictionary representing a row (key/value pairs) - A Dictionary - where keys are column names - values are the Series representing a column - the index of the Series becomes *row* names of the DataFrame

[8]:

```
prices     = pd.Series( { "FB": 150, "AAPL": 156, "AMZN": 1700, "NFLX": 340,␣
↪"GOOG": 1100 } )
full_names = pd.Series( { "FB": "Facebook", "AAPL": "Apple", "AMZN": "Amazon",
                         "NFLX": "Netflix", "GOOG": "Google"
                        } )

stocks = pd.DataFrame({ "price": prices, "name": full_names })
stocks
```

[8]:

	price	name
FB	150	Facebook
AAPL	156	Apple
AMZN	1700	Amazon
NFLX	340	Netflix
GOOG	1100	Google

[9]:

```
ticker = "AMZN"
print( "Ticker {t}: price: {p}, full name: {fn}".format(t=ticker,
                                                        p=stocks.loc[ticker,␣
↪"price"],
                                                        fn=stocks.loc[ticker,␣
↪"name"]
                                                       )
     )
```

```
Ticker AMZN: price: 1700, full name: Amazon
```

Notice how we indexed symbolically into the DataFrame: `stocks.loc[ticker, "price"]`

More on indexing.

1.2.2 Display

[10]:

```
stocks.head(2)

stocks.tail(3)
```

[10]:

	price	name
FB	150	Facebook
AAPL	156	Apple

[10]:

	price	name
AMZN	1700	Amazon
NFLX	340	Netflix
GOOG	1100	Google

1.2.3 Data Indexing and Selection

VanderPlas

There is more than one way to index, and it gets confusing !

Personally, I just use one-way: the `.loc`indexer

[11]:
```
print("Price column via .price attribute:\n", stocks.price)

# What would happen if "price" were in both the row index and the column index ?
print("\nPrice column via named column (implicitly the column):\n",␣
↪stocks["price"])

print("\nPrice column via .loc indexer:\n", stocks.loc[:, "price"])
```

```
Price column via .price attribute:
 FB       150
AAPL     156
AMZN    1700
NFLX     340
GOOG    1100
Name: price, dtype: int64

Price column via named column (implicitly the column):
 FB       150
AAPL     156
AMZN    1700
NFLX     340
GOOG    1100
Name: price, dtype: int64

Price column via .loc indexer:
 FB       150
AAPL     156
AMZN    1700
NFLX     340
GOOG    1100
Name: price, dtype: int64
```

Common "gotcha" Note the difference in return type for the two slightly statements

[12]:
```
print("Arg. is an array with a single element")
stocks.loc[:, ["price"] ]
type(stocks.loc[:, ["price"] ] )

print("Arg. is a singleton")
stocks.loc[:,  "price" ]
```

```
type(stocks.loc[:,  "price" ])
```

```
Arg. is an array with a single element
```

[12]:
```
      price
FB      150
AAPL    156
AMZN   1700
NFLX    340
GOOG   1100
```

[12]:
```
pandas.core.frame.DataFrame
```

```
Arg. is a singleton
```

[12]:
```
FB       150
AAPL     156
AMZN    1700
NFLX     340
GOOG    1100
Name: price, dtype: int64
```

[12]:
```
pandas.core.series.Series
```

Index alignment Indices are more than a convenient feature for indexing. They have semantic meaning in that they align two Series or DataFrames

[13]:
```
series1 = pd.Series( { "a": 1,   "b": 2,         "d": 4})
series2 = pd.Series( { "a": 10,         "c": 30, "d": 44 })

series1
series2

series1 + series2
series2 + series1
```

[13]:
```
a    1
b    2
d    4
dtype: int64
```

[13]:
```
a    10
c    30
d    44
dtype: int64
```

[13]:
```
a    11.0
b     NaN
c     NaN
d    48.0
dtype: float64
```

[13]:
```
a    11.0
b     NaN
c     NaN
d    48.0
dtype: float64
```

Slices You can use slices in Index !

Note that, unlike in Python, the upper bound is **inclusive**

Slices are particularly useful when you have DatetimeIndex (an index consisting of dates)

[14]:
```python
stocks.loc["AMZN": "GOOG"]
```

[14]:
```
      price     name
AMZN   1700   Amazon
NFLX    340  Netflix
GOOG   1100   Google
```

Adding a column

[15]:
```python
stocks["sector"] = pd.Series( { "FB": "Tech", "AAPL": "Tech", "AMZN": "ConsD", "NFLX": "ConsD"})
stocks
```

[15]:
```
      price      name sector
FB      150  Facebook   Tech
AAPL    156     Apple   Tech
AMZN   1700    Amazon  ConsD
NFLX    340   Netflix  ConsD
GOOG   1100    Google    NaN
```

Note the missing values.

1.3 Operations on Series and DataFrames

The usual suspects, plus vector operations like NumPy.

Note that the default `axis=0`, just like NumPy

[16]:
```python
stocks.loc[:, "price"].mean()
```

[16]: 689.2

1.3.1 apply

There are lots of methods (hard to remember them all). Don't forget the old standby: `apply`

The `apply` method to applies your own function, either column-wise or row-wise (depending on axis chosen)

[17]:
```
def my_func(s):
    # If you don't understand what is passed (Series or DataFrame), or whether␣
↪it it row or column, try this:
    print("Type of s is {t}, shape is {sh}".format(t=type(s), sh=s.shape))

    # s is a series
    return s.mean()

stocks.loc[:, ["price"] ].apply(my_func, axis=0)
```

```
Type of s is <class 'pandas.core.series.Series'>, shape is (5,)
```

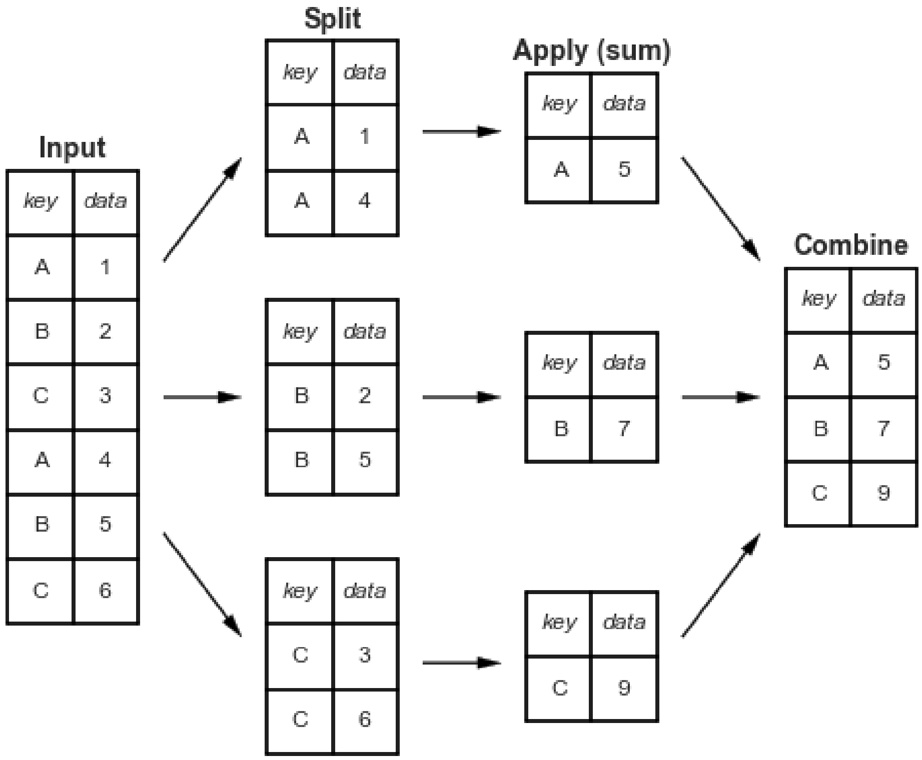
[17]:
```
price    689.2
dtype: float64
```

1.3.2 Database (and Spreadsheet) like operations

Aggregation and grouping VanderPlas

The "split-apply-combine" paradigm (VanderPlas) should be familiar to users of SQL, where the operation is called `group by`

- split the DataFrame into groups by filtering the rows on some criteria
- apply a function to each group, returning another DataFrame
- combine the DataFrame from each group result into a single DataFrame



[18]:
```python
stocks.groupby("sector")
```

[18]: <pandas.core.groupby.groupby.DataFrameGroupBy object at 0x7f8505b34e80>

[19]:
```python
def my_group_func(df):
    return df.loc[:, "price"].mean()

stocks.loc[:, ["price", "sector"] ].groupby("sector").aggregate(my_group_func)
```

[19]:

	price
sector	
ConsD	1020.0
Tech	153.0

Joining, concatenation, pivot VanderPlas

It is very rare that you are given a single dataset organized exactly as you like. Often it comes in separate pieces (i.e., from different database tables or vendors) that must be joined.

You can combine two DataFrames in a manner just like an SQL join of two tables, where the join column is the Index of the two DataFrames. Remember: Index is used for alignment as well as convenience.

We will explore this in our module on Data Transformations.