PS5841

Data Science in Finance & Insurance

Data Wrangling

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Autumn 2021

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Numpy ndarray

- ndarray
  - a homogeneous multidimensional array
    - Dimensions are called axes
  - a table of elements of the same type indexed by a tuple of non-negative integers

Numpy ndarray Indexing

- Indexing

```
a[0:2]
```

- Fancy Indexing
  - Indexing with arrays of indices

```
a[[…],[…]]
```

  - Indexing with Boolean arrays

```
a[a>10]
```

  - Indexing with strings
    - Structured Arrays - ndarrays whose datatype is a composition of simpler datatypes organized as a sequence of named fields

```
a[‘uni’]
```

Numpy Broadcasting (1)

- Broadcasting – rules for working with two ndarrays
- Rule 1 – If the two arrays differ in their number of dimensions, the shape of the one with fewer dimensions is padded with ones on its leading (left) side
- Rule 2 – If the shape of the two arrays does not match in a particular dimension, the array with shape equal to 1 in that dimension is stretched to match the other shape
- Rule 3 – If in any dimension the sizes disagree and neither is equal to 1, an error is raised

Numpy Broadcasting (2)

```
np.ones((2,3)) + np.arange(3)
```

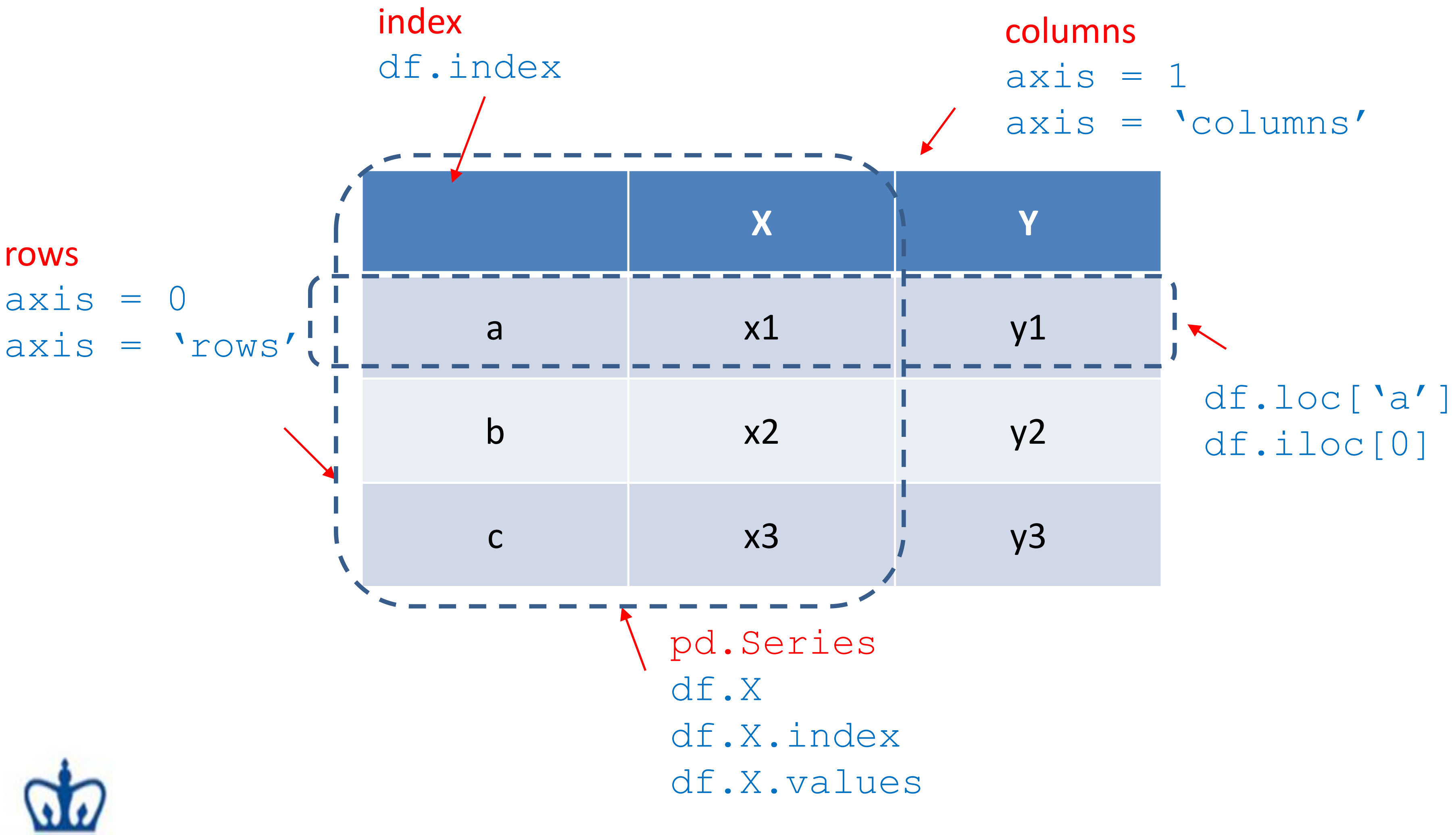
$$\begin{pmatrix}1 & 1 & 1\\1 & 1 & 1\end{pmatrix}_{(2,3)} + \begin{pmatrix}0\\1\\2\end{pmatrix}_{(3,)}$$

$$rule\ 1 \rightarrow \begin{pmatrix}1 & 1 & 1\\1 & 1 & 1\end{pmatrix}_{(2,3)} + \begin{pmatrix}0 & 1 & 2\end{pmatrix}_{(1,3)}$$

$$rule\ 2 \rightarrow \begin{pmatrix}1 & 1 & 1\\1 & 1 & 1\end{pmatrix}_{(2,3)} + \begin{pmatrix}0 & 1 & 2\\0 & 1 & 2\end{pmatrix}_{(2,3)}$$

$$\rightarrow \begin{pmatrix}1 & 2 & 3\\1 & 2 & 3\end{pmatrix}_{(2,3)}$$

Pandas DataFrame



index
df.index

columns
axis = 1
axis = ‘columns’

rows
axis = 0
axis = ‘rows’

	X	Y
a	x1	y1
b	x2	y2
c	x3	y3

df.loc[‘a’]
df.iloc[0]

pd.Series
df.X
df.X.index
df.X.values

pandas.DataFrame()

Wide vs Long Format

- Wide format

```
     A  B  C  D
0  jan  1  4  7
1  feb  2  5  8
2  mar  3  6  9
```

- Long format

```
     A variable  value
0  jan        B      1
1  feb        B      2
2  mar        B      3
3  jan        C      4
4  feb        C      5
5  mar        C      6
6  jan        D      7
7  feb        D      8
8  mar        D      9
```

Dummy Variables

- Categorical features are often modeled by binary (dummy) variables in a regression
- For a factor with J levels
  - Need J binary variables if there is no intercept
  - Need (J-1) binary variables if intercept
  - Baseline is the level with no dummy variable
- Example: 1 factor with 3 levels (A,B,C)
  - with baseline A

$$y = \beta_0 + \beta_1 x_B + \beta_2 x_C + \beta_3 x_3 + \beta_4 x_4 + \epsilon$$

  - How are $\hat{\beta}_j$'s interpretated?

```
pandas.get_dummies()
```

That was