Python Pandas: Dataframes

Programming for Data Science with Python

Overview

What is NDFrame?

N-dimensional analogue of DataFrame. Store multi-dimensional in a size-mutable, labeled data structure.

What's a DataFrame?

class DataFrame(NDFrame): **Two-dimensional** size-mutable, potentially heterogeneous tabular data structure with labeled axes (**rows and columns**). Arithmetic operations align on both row and column labels. Can be thought of as a **dict-like** container for **Series** objects.

- DataFrame is a subclass (i.e., special case) of NDFrame.
- In Pandas programs generally, DataFrame is used a lot and NDFrame is used rarely.
- In fact, Pandas has Series for 1D, DataFrame for 2D, and for most people that's the end(even though half of Pandas' name is for Panel which Pandas also has, but most people do not use).

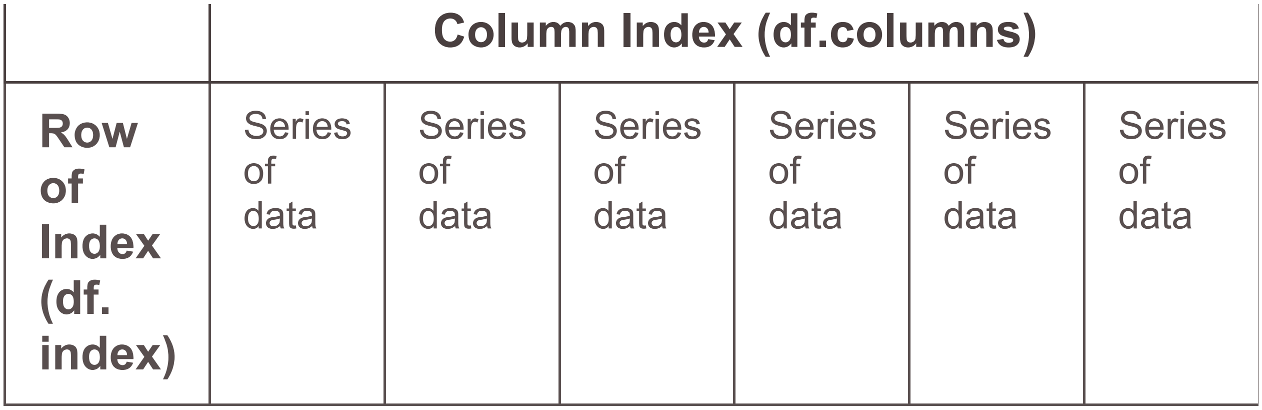
FUN FACT: There is/was even a 4D thing in Pandas, (but truly no one uses it (this being the internet, someone will now appear to say they do!).

For higher dimensions than two or maybe three, some people have shifted their efforts to **xarray**.

That's probably where it's at if your ambitions cannot be contained in 2D.

1.1 Definition

A Data frame is a two-dimensional data structure, i.e., data is aligned in a tabular fashion in rows and columns.



	Column Index (df.columns)					
Row of Index (df. index)	Series of data	Series of data	Series of data	Series of data	Series of data	Series of data

1.2 pandas.DataFrame: Attributes

T → Transpose index and columns

at → Fast label-based scalar accessor

axes → Return a list with the row axis labels and column axis labels as the only members.

blocks → Internal property, property synonym for as_blocks()

dtypes → Return the dtypes in this object.

empty → True if NDFrame is entirely empty [no items], meaning any of the axes are of length 0.

Ftypes → Return the ftypes (indication of sparse/dense and dtype) in this object.

iat → Fast integer location scalar accessor.

iloc → Purely integer-location based indexing for selection by position.

ix → A primarily label-location based indexer, with integer position fallback.

loc → Purely label-location based indexer for selection by label.

ndim → Number of axes/array dimensions.

shape → Return a tuple representing the dimensionality of the DataFrame.

size → number of elements in the NDFrame

style → Property returning a Styler object containing methods for building a styled HTML representation for the DataFrame.

values → Numpy representation of NDFrame.

2. Create Dataframes

2.1DataFrame Constructor

pandas.DataFrame(data, index, columns, dtype, copy)

Data:

- can be ndarray, series, map, lists, diet, constants, and another DataFrame.

Index:

- For the row labels, the index to be used for the resulting frame is Optional Default np.arrange(n),if no index is passed.

Columns:

- For column labels, the Optional Default syntax is - np.arrange(n). This is only true if no index is passed.

dtype:

- Data type of each column

Copy:

- This command (or whatever it is) is used for copying of the data.

Default: False

2.2 Create an Empty Dataframe

Run the following code block:

In [1]:

```
# Create an empty dataframe

import pandas as pd

df = pd.DataFrame()
print(df)
```

```
Empty DataFrame
Columns: []
Index: []
```

2.3 Create a Dataframe from lists

Run the following 2 code blocks:

In [2]:

```
# Create a dataframe from a list
import pandas as pd

# Declare a list
alist = [1,2,3,4,5]

# Create a dataframe from the list
df = pd.DataFrame(alist)

print(df)
```

```
   0
0  1
1  2
2  3
3  4
4  5
```

In [3]:

```python
# Create a dataframe from a list of lists

import pandas as pd

# Declare a list of lists - each list element has two elements [string
alistOflists = [['Alex',10],['Bob',12],['Clarke',13]]

# Create a dataframe from this list, naming the columns as 'Name' and
df = pd.DataFrame(alistOflists, columns=['Name', 'Age'])

print(df)
```

```
     Name  Age
0    Alex   10
1     Bob   12
2  Clarke   13
```

In [4]:

```python
# Create a dataframe from a list of lists and set the data type
import pandas as pd

# Declare a List of Lists - each list element has two elements [string
aListOfLists = [['Alex',10], ['Bob',12], ['Clarke',13]]

# Create a dataframe from this list, naming the columns as 'Name' and
df = pd.DataFrame(aListOfLists, columns=['Name', 'Age'], dtype=float)

print(df)
```

```
     Name   Age
0    Alex  10.0
1     Bob  12.0
2  Clarke  13.0
```

2.4 Create dataframes from dictionaries of ndarray/lists

- All the ndarrays must be of same length.
- If index is passed, then the length of the index should equal to the length of the arrays.
- If no index is passed, then by default, index will be range(n), where n is the array length.

Run the following 3 code blocks:

In [5]:

```
# Create a dataframe from a dictionary without specified indices

import pandas as pd

# Declare a dictionary that has two key-value pairs
# One key is "Name" that has its value = a list of strings
# Another key is "Age" that has its value = a list of integers

aDict = {'Name':['Tom','Jack','Steve','Ricky'],'Age': [28,34,29,42]}

# Create the dataframe from the dictionary
# VIP NOTES: Automatically adding the indices for the rows

df = pd.DataFrame(aDict)
print(df)
```

```
    Name  Age
0    Tom   28
1   Jack   34
2  Steve   29
3  Ricky   42
```

In [16]:

```
# Create a dataframe from a dictionary with specified indices

import pandas as pd

# Declare a dictionary that has two key-value pairs
# One key is "Name" that has its value = a List of strings
# Another key is "Age" that has its value = a list of integers

aDict = {' Name' :['Tom', 'Jack', 'Steve', 'Ricky'], 'Age' : [28,34,29

# Create the dataframe from the dictionary
# VIP NOTES: Specifying the indices for the rows

df = pd.DataFrame(aDict, index=['rankl', 'rank2', 'rank3', 'rank4'])
print(df)
```

```
        Name  Age
rankl    Tom   28
rank2   Jack   34
rank3  Steve   29
rank4  Ricky   42
```

In [7]:

```
# Create a dataframe from a dictionary of series

import pandas as pd

# Declare a dictionary of 2 series named 'one' and 'two'

aDictOfSeries = {'one': pd.Series([1, 2, 3], index=['a', 'b', 'c']),
         'two': pd.Series([1, 2, 3, 4], index=['a', 'b', 'c', 'd'])}

# Create a dataframe from this dictionary
# VIP NOTES: Each column of a dataframe is a series

df = pd.DataFrame(aDictOfSeries)
print(df)
```

```
   one  two
a  1.0    1
b  2.0    2
c  3.0    3
d  NaN    4
```

2.5 Access Dataframe Columns

Run the following code block:

In [8]:

```
# Access a dataframe columns

import pandas as pd

# Declare a dictionary of 2 series named 'one' and 'two'
aDictOfSeries = {'one': pd.Series([1, 2, 3], index= ['a', 'b', 'c']),
'two': pd.Series([1, 2, 3, 4], index=['a', 'b', 'c', 'd'])}

# Create a dataframe from this dictionary
# VIP NOTES: Each column of a dataframe is a series

df = pd.DataFrame(aDictOfSeries)

# Access the column 'one' and print it out
# HOW TO access a column: Using its label as a column index

print(df['one'])
```

```
a    1.0
b    2.0
c    3.0
d    NaN
Name: one, dtype: float64
```

2.6 Add Columns into a Dataframe

Run the following 2 code blocks:

In [9]:

```
# Add columns into a dataframe

import pandas as pd

# Declare a dictionary of 2 series named 'one' and 'two'
aDictOfSeries = {'one': pd. Series ([1, 2, 3], index= ['a', 'b', 'c'])

# Create a dataframe from this dictionary
# VIP NOTES: Each column of a dataframe is a series

df = pd.DataFrame(aDictOfSeries)

# Adding a new column to an existing DataFrame object with column labe
# Adding a new series into the dataframe as a new column: 'three'
# First, creating a new series
# Then, assign the new series into the new column

df['three']=pd.Series([10, 20, 30],index=['a', 'b', 'c'])
print(df)
```

```
   one  two  three
a  1.0    1   10.0
b  2.0    2   20.0
c  3.0    3   30.0
d  NaN    4    NaN
```

In [10]:

```
# Adding a new column using the existing columns in Data Frame

df['four'] = df['one'] + df['three']
print('\n')
print(df)
```

```


   one  two  three  four
a  1.0    1   10.0  11.0
b  2.0    2   20.0  22.0
c  3.0    3   30.0  33.0
d  NaN    4    NaN   NaN
```

2.7 Delete/Pop/Remove a Column from a Dataframe

Run the following code block:

In [11]:

```
# Delete a column using del function
import pandas as pd
# Declare a dictionary of 2 series named 'one' and 'two'
aDictOfSeries = {'one': pd.Series ([1, 2, 3],
index = ['a', 'b', 'c']),'two': pd.Series([1, 2, 3, 4],
index = ['a', 'b', 'c', 'd']), 'three': pd.Series([10,20,30],
index = ['a', 'b', 'c'])}
# Create a dataframe from this dictionary
# VIP NOTE: Each column of a dataframe is a series
df = pd.DataFrame(aDictOfSeries)
print(df)
print('\n')
# using del function to delete/remove the first column
del(df['one'])
print(df)
print('\n')
# using pop function to delete another column " 'two'
# Deleting another column using PDP function
df.pop('two')
print(df)
```

```
   one  two  three
a  1.0    1   10.0
b  2.0    2   20.0
c  3.0    3   30.0
d  NaN    4    NaN


   two  three
a    1   10.0
b    2   20.0
c    3   30.0
d    4    NaN


   three
a   10.0
b   20.0
c   30.0
d    NaN
```

2.8 Access Rows of a Dataframe → loc & iloc

Run the following 3 code blocks:

In [12]:

```
# Access rows of a dataframe using Loc function
# Loc is a row index

import pandas as pd

aDictOfSeries = {'one': pd.Series ([1, 2, 3], index=['a', 'b', 'c']),
'two':pd.Series([1, 2, 3, 4], index=['a', 'b', 'c', 'd'])}

df = pd.DataFrame(aDictOfSeries)

# Access the row with index='b' and print the row
print(df.loc['b'])
```

```
one    2.0
two    2.0
Name: b, dtype: float64
```

In [13]:

```
# Access rows of a dataframe using iLoc (integer Location/row index) f

import pandas as pd

aDictOfSeries = {'one': pd.Series ([1, 2, 3], index= ['a', 'b', 'c']),
'two': pd.Series([1, 2, 3, 4], index=['a', 'b', 'c' , 'd'])}

df = pd.DataFrame(aDictOfSeries)

# Access the row with index= '2' and print the row
print(df.iloc[2])
```

```
one    3.0
two    3.0
Name: c, dtype: float64
```

In [14]:

```
# Access a group of rows using the ':' operator

import pandas as pd

aDictOfSeries = {'one': pd.Series ([1, 2, 3], index= ['a', 'b', 'c']),
'two': pd.Series([1, 2, 3, 4], index=['a', 'b', 'c', 'd'])}

df = pd.DataFrame(aDictOfSeries)

# Access all the rows with indices 2, 3 and print them
print(df[2:4])
```

```
   one  two
c  3.0    3
d  NaN    4
```

2.9 Delete/Remove Rows from a Dataframe

Run the following code block:

In [15]:

```
# Remove rows from a dataframe using the drop() function

import pandas as pd

df = pd.DataFrame([[1, 2] , [3, 4]], columns = ['a', 'b'])
df2 = pd.DataFrame([[5, 6], [7, 8]], columns = ['a', 'b'])

df = df.append(df2)

# Drop rows with Label 0
df = df.drop(0)

print(df)
```

```
   a  b
1  3  4
1  7  8
```

3. Load Data into DataFrame

To read data into a dataframe, we use this command:

pd.read_file_type(file_name)

Where file_type can be csv, excel, etc.

For example, for CSV files, the command to read a csv file: pd.read_csv()

Example:

You will have your datasets already loaded but I want you to have an exaple in case you challenge yourself and work on your own.

```
import pandas as pd
```

Reads the flights data set and create the dataframe flights

```
df_flights = pd.read_csv
('C:/DATA/DROPBOX/Dropbox/DATA_APPLS/DATASETS/flights_2
. csv')
```

The command below would print out the 1st 5 rows of the dataframe that was created.

```
df_flights.head(5)
```