Pandas

What is Pandas

pandas is a fast, powerful, flexible and easy to use open source data analysis and manipulation tool,
built on top of the Python programming language.

Source: pandas.pydata.org

Important DataTypes

- Series
  - 1-D, like an array
  - has only one index called '*index*'

- DataFame
  - 2-D
  - has indexes for both columns and rows, called '*columns*' and '*index*' respectively

Series creation

- pd.Series(<sequence type>)
- pd.Series(<sequence>, index=<list of corresponding index>)

- Indexes can be customized using the '*index*' option.
- Default indexes are numbers starting from *0* till *n-1*.

Series Datatype

- Common attributes
  - shape
  - size
  - dtype
  - index
  - values
- Aggregate functions (there is one dimension, so no need of axis)
  - min, max
  - sum, mean etc.
  - unique
  - value_counts

Series operations and broadcasting

- Arithmetic operations
  - +, -, *, %, / etc.
  - Series operation with a scalar broadcast it to each and every element of series
- Relational operations
  - Operators like ==, <, >, <=, >=, !=
  - These generate a corresponding series of Booleans for each element
- Logical operations
  - Like &, |, ~ etc

Series indexing and slicing

- Series objects have only one dimension to be indexed and sliced

```
>>> <series>[ index ]

>>> <series>[ start: end: step ]
```

- Result of index is same as dtype/ type of single element

- Result of a slice is a new Series

- Boolean indexing is supported (Position where there is a True is kept)

```
>>> <series> [<series of True/False>]
```

DataFrames

- Mostly DataFrame is created when using a function which reads data from a file format, like:
  - read_csv
  - read_excel etc.

- DataFrames can be created directly using a dictionary or a list of tuples. Each tuple denoting a row

- Common attributes
  - shape
  - size
  - dtype
  - index
  - columns
  - T
- Aggregate functions (axis =0,1 controls column or row major)
  - min, max
  - sum, mean etc.
  - Unique

- Indexing

```
>>> <dataframe> [ <column name> ]

>>> <dataframe> . <column name>
```

- For using second option, the column name must be a valid python identifier
- Since column names can be types other then string, hence first syntax can be used for all kinds of column names. Whether string or numeric type.

- Viewing Data

```
>>> <dataframe>.head(<count>)

>>> <dataframe>.tail(<count>)

>>> <dataframe>.describe(include="all")
```

- DataFrame and Series
  - Each column in a DataFrame is a Series object.
  - Hence, all operations available on a Series are applicable to columns of a DataFrame

- Rename and in-place operations

```
>>> <dataframe>.rename(
            columns=<mapping funct/dict>,
            index = <mapping funct/dict>,
            inplace=False
    )
```

- When inplace is False, a new copy of data is returned and original DataFrame does not change

- When inplace=True, original DataFrame gets updated and a None is returned

- Indexing and Slicing: loc, iloc

```
>>> <dataframe>.loc[<rows>, <columns>]
```
loc is used to index based on row and column names

```
>>> <dataframe>.iloc[<rows>, <columns>]
```
iloc is used to index based on row and column indexes even though names might be assigned

- For slicing using loc and iloc, the : notation is used

- NA methods

• isna	Check each element is NA or not
• fillna	Fill na with values or some fill method
• dropna	Works on basis of threshold

Usually Pandas ignores NaN values in aggregate operations unlike how it is in case of Numpy.

- Boolean Methods

• any	Anything is a true value
• all	Everything should be a true value

- Sorting/Ordering

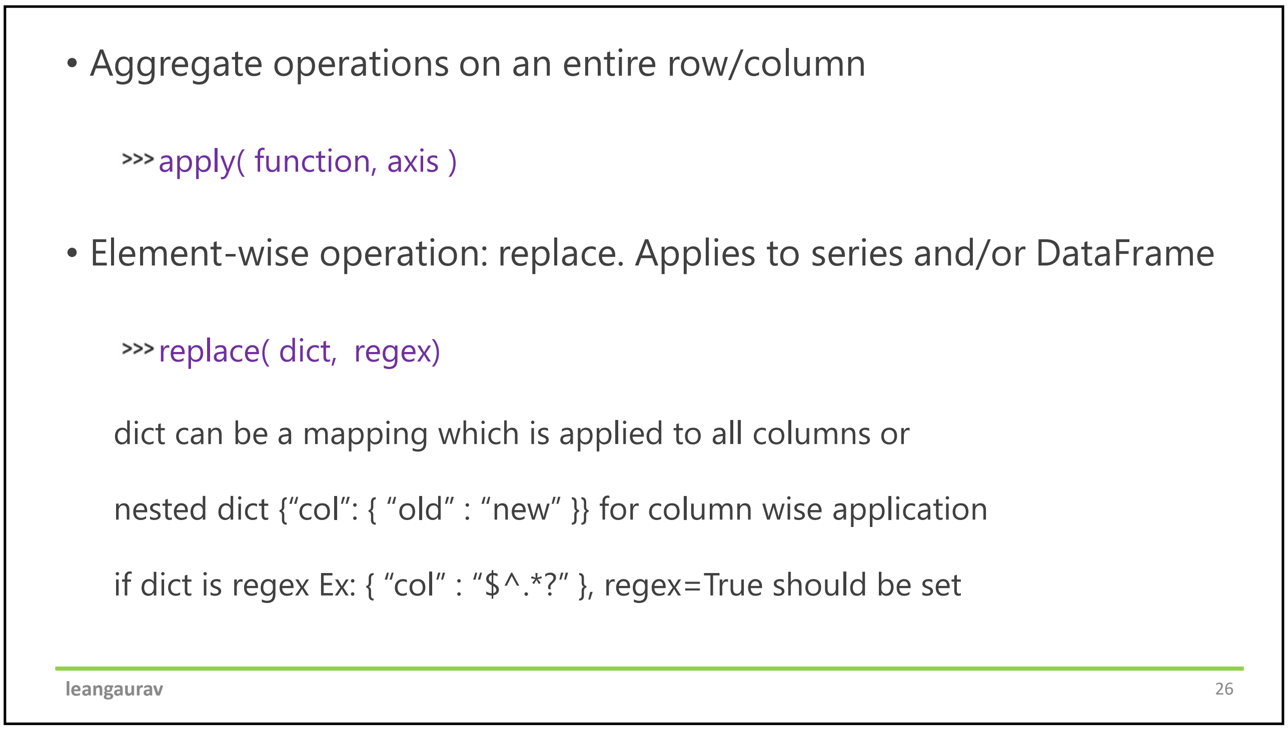
```
>>> df.sort_values (
        by = <col/list of columns>,
        ascending=True
    )
```

- Sorts value on basis of one or more columns
- Can be used with tail and head functions to get *top-n* rows etc.

- Another option is nlargest or nsmallest

- Saving DataFrame
  - to_csv
  - to_excel etc.   Excel option requires extra operations

- DataFrames can be conveniently saved to a desired file format using any of the *'to_format'* functions.



- Aggregate operations on an entire row/column

```
>>> apply( function, axis )
```

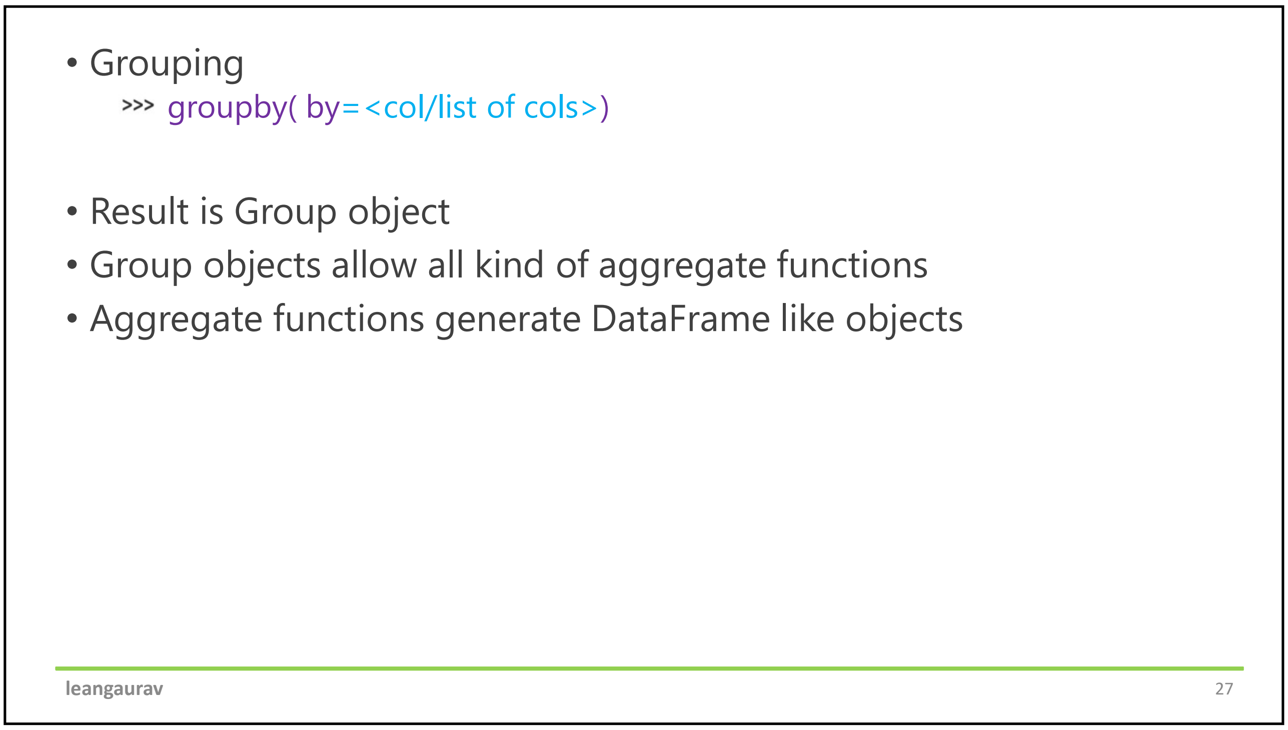
- Element-wise operation: replace. Applies to series and/or DataFrame

```
>>> replace( dict,  regex)
```

dict can be a mapping which is applied to all columns or

nested dict {“col”: { “old” : “new” }} for column wise application

if dict is regex Ex: { “col” : “$^.*?” }, regex=True should be set



- Grouping

```
>>> groupby( by=<col/list of cols>)
```

- Result is Group object
- Group objects allow all kind of aggregate functions
- Aggregate functions generate DataFrame like objects

Plotting and Matplotlib

What is Matplotlib

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python.

Source : https://matplotlib.org/

Pick the correct plot

- Since a graph is a visual way of representing data
- Picking correct plot is important to convey your thoughts
- Simplistic plots with no distracting elements

Usage

- Importing

```
>>>import matplotlib.pyplot as plt
```

- Matplotlib is the base library for multiple other plotting libraries

Simple line plot

- Use list/nparray/Series or any array like data

```
>>>plot (<xcoord>, <ycoord>,  <color, symbol options>)
```

- Ex:

```
plot( [1,2,3], [1,4,9], 'ro')
```

Controlling Multiple plots

- Multiple plot calls display on the same graph.

```
>>>plt.show()
```

- Multiple plots on same window

```
>>>plt.subplot(row, col, index)
```

- Create new figure windows using

```
>>>figure()
```

Annotating your graphs

- Label on x,y axis

```
>>>xlabel()
>>>ylabel()
```

- Setting markers/ticks

```
>>>xticks()
>>>yticks()
```

specify markers on x and y axis, rotation etc.

- Display a legend. Works only if you have set labels for the plots

```
>>>legend()
```

- Set graph title/heading

```
>>>title()
```

- Add some text

```
>>>text( x, y, “text”)
```

Inserts a single text element; requires loop otherwise

Draw line and Saving

- Horizontal and vertical lines

```
>>> axvline( x )        # draw vertical line
>>> axhline( y )        # draw horizontal line
```

- Save a figure

```
>>> savefig(filename)
```

Percentages / Comparison for categorical data

- Pie Charts

```
>>> pie(data):
shadow    :     Boolean
explode   :     [list of floats]
labels, labeldistance
```

- Horizontal or Vertical bar plots:

```
>>> bar(x, values):
label     :     Used by legend option
bottom    :     used to create stacked bar plot
```

Histogram for distribution

- Method name

  ```
  >>> hist()
  ```

  bins : integer
  rwidth : Width of bars; float [0 - 1.0]

- Frequency distribution of data grouped into ranges
- Bar like representation for non-categorical data

Areas and stacked area

- Area Plots

  ```
  >>> fill_between(x, y)
  ```

- Control alpha/transparency
- Fill between *x*, *y1*, *y2* to achieve stacked effect

Boxplot for skewness and outliers

- Method

>>> boxplot(data):

data	:	can be array or a matrix for multiple plots

Scatter for multiple attributes

- Multiple *y* vars for a common *x* var.

>>> plt.scatter()

color	:	string
s	:	integer size
alpha	:	float [0 – 1.0]
marker	:	o,_,^, $...$

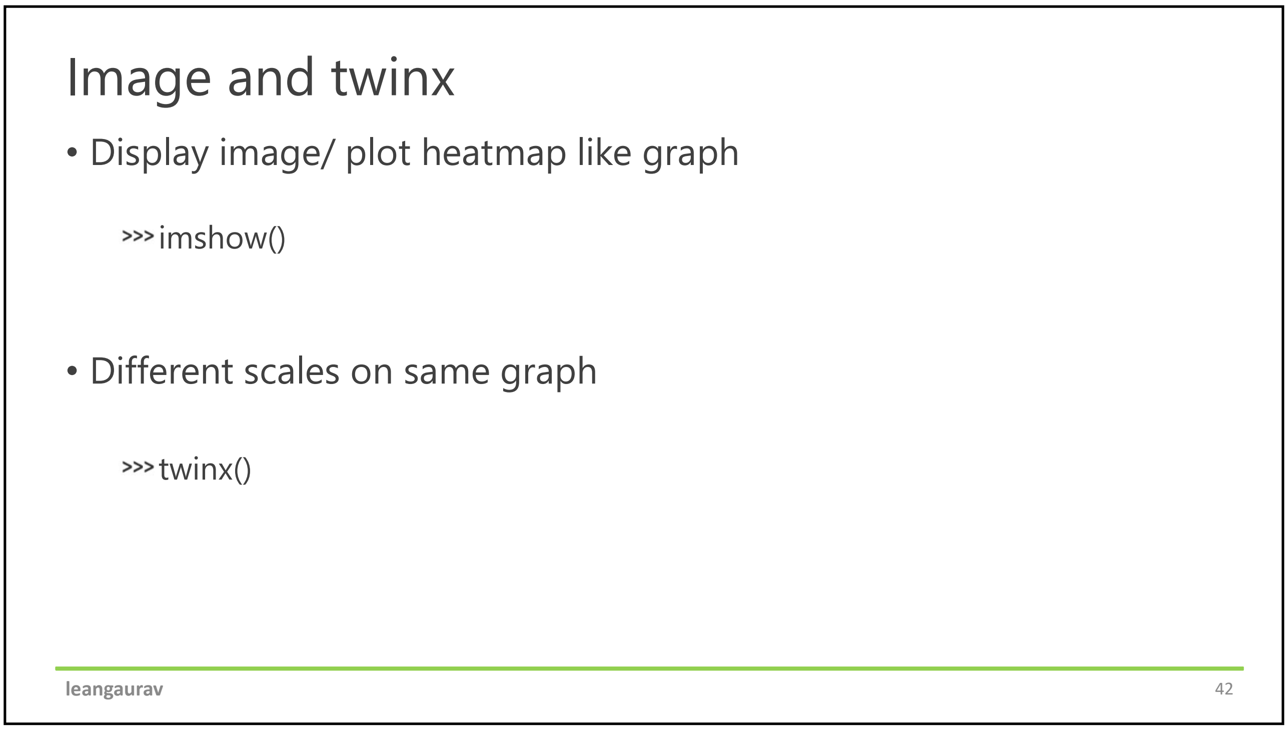


Image and twinx

- Display image/ plot heatmap like graph

  >>> imshow()

- Different scales on same graph

  >>> twinx()