Lesson #08
Combination Data with Pandas

March 2019

Introduction to Pandas
Exploring Data with Pandas
Data Cleaning Basics
Data Aggregation
Combining Data with Pandas
Transforming Data with Pandas
Working with String in Pandas
Working with missing and duplicate data

- Combining Dataframes with the concat()
- Joining Dataframes with the merge()

Update from repository

```
git clone https://github.com/ivanovitchm/datascience_one_2019_1
```

Or ....

```
git pull
```

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Data Kernels (421) Discussion (6) Activity Download (29 KB) New Kernel

CC0: Public Domain economics, social sciences, emotion

It's very common in practice to work with more than one data set at a time.

Data Sources

2015.csv	158 x 12
2016.csv	157 x 13
2017.csv	155 x 12

Introduction to data set

Country	Region	Happiness Rank	Happiness Score	Standard Error	Economy (GDP per Capita)	Family
Switzerland	Western Europe	1	7.587	0.03411	1.39651	1.34951
Iceland	Western Europe	2	7.561	0.04884	1.30232	1.40223
Denmark	Western Europe	3	7.527	0.03328	1.32548	1.36058
Norway	Western Europe	4	7.522	0.0388	1.459	1.33095
Canada	North America	5	7.427	0.03553	1.32629	1.32261

Df1

	Column 1	Column 2
0	A	B

Df2

	Column 1	Column 2
0	C	D

Axis = 0

Concatenated

	Column 1	Column 2
0	A	B
0	C	D

Since we imported pandas as "pd", we use this naming convention to access the concat function.

Pass the dataframes you want to combine into the function as a list.

```
pd.concat( [df1, df2] )
```

Axis = 1

Df1

	Column 1
0	A
1	C

Df2

	Column 2
0	B
1	D

Concatenated

	Column 1	Column 2
0	A	B
1	C	D

	Country	Happiness Score	Year
0	Switzerland	7.587	2015
1	Iceland	7.561	2015
2	Denmark	7.527	2015

	Country	Happiness Score	Year
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

```
pd.concat([head_2015,head_2016],axis=0)
```

	Country	Happiness Score	Year
0	Switzerland	7.587	2015
1	Iceland	7.561	2015
2	Denmark	7.527	2015
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

	Country	Happiness Score	Year
0	Switzerland	7.587	2015
1	Iceland	7.561	2015
2	Denmark	7.527	2015

	Country	Happiness Score	Year
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

```
pd.concat([head_2015,head_2016],axis=1)
```

	Country	Happiness Score	Year	Country	Happiness Score	Year
0	Switzerland	7.587	2015	Denmark	7.526	2016
1	Iceland	7.561	2015	Switzerland	7.509	2016
2	Denmark	7.527	2015	Iceland	7.501	2016

	Year	Country	Happiness Score	Standard Error
0	2015	Switzerland	7.587	0.03411
1	2015	Iceland	7.561	0.04884
2	2015	Denmark	7.527	0.03328
3	2015	Norway	7.522	0.03880

	Country	Happiness Score	Year
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

```
pd.concat([head_2015,head_2016],axis=0)
```

	Country	Happiness Score	Standard Error	Year
0	Switzerland	7.587	0.03411	2015
1	Iceland	7.561	0.04884	2015
2	Denmark	7.527	0.03328	2015
3	Norway	7.522	0.03880	2015
0	Denmark	7.526	NaN	2016
1	Switzerland	7.509	NaN	2016
2	Iceland	7.501	NaN	2016

	Year	Country	Happiness Score	Standard Error
0	2015	Switzerland	7.587	0.03411
1	2015	Iceland	7.561	0.04884
2	2015	Denmark	7.527	0.03328
3	2015	Norway	7.522	0.03880

	Country	Happiness Score	Year
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

```
pd.concat([head_2015,head_2016],axis=0,ignore_index=True)
```

	Country	Happiness Score	Standard Error	Year
0	Switzerland	7.587	0.03411	2015
1	Iceland	7.561	0.04884	2015
2	Denmark	7.527	0.03328	2015
3	Norway	7.522	0.03880	2015
4	Denmark	7.526	NaN	2016
5	Switzerland	7.509	NaN	2016
6	Iceland	7.501	NaN	2016

	Year	Country	Happiness Score	Standard Error
0	2015	Switzerland	7.587	0.03411
1	2015	Iceland	7.561	0.04884
2	2015	Denmark	7.527	0.03328
3	2015	Norway	7.522	0.03880

	Country	Happiness Score	Year
0	Denmark	7.526	2016
1	Switzerland	7.509	2016
2	Iceland	7.501	2016

```
pd.concat([head_2015,head_2016],axis=1)
```

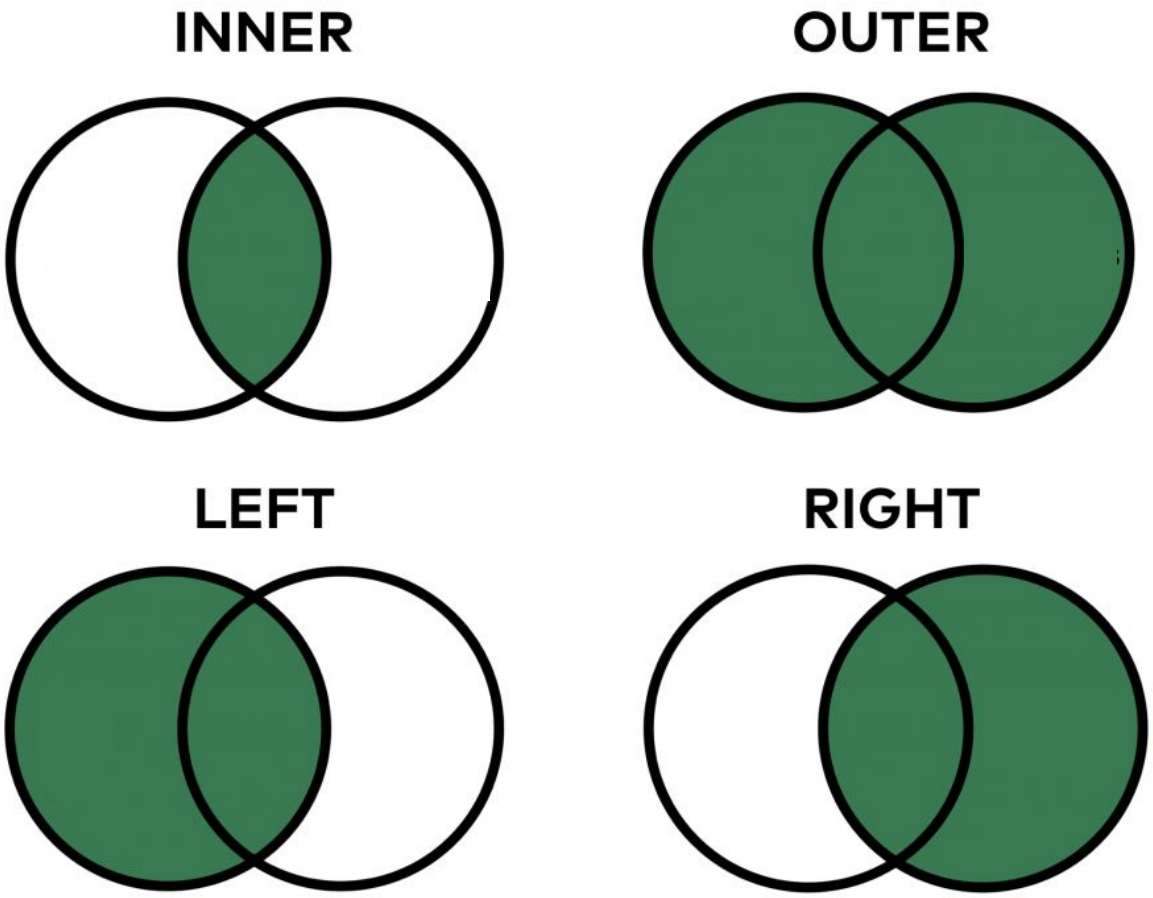
	Year	Country	Happiness Score	Standard Error	Country	Happiness Score	Year
0	2015	Switzerland	7.587	0.03411	Denmark	7.526	2016.0
1	2015	Iceland	7.561	0.04884	Switzerland	7.509	2016.0
2	2015	Denmark	7.527	0.03328	Iceland	7.501	2016.0
3	2015	Norway	7.522	0.03880	NaN	NaN	NaN

Lesson #08 - Combining Data With Pandas.ipynb
Up to section 1.4

Python Pandas

merge

- Merge can execute **high performance** database-style **joins**
- Only combines dataframes horizontally (axis=1)
  - Index
  - Column
- Can only combine two dataframes at a time
- However, it can be valuable when we need to combine very **large dataframes** quickly
- It provides more flexibility in terms of how data can be combined (outer, inner, left, right)


INNER
OUTER
LEFT
RIGHT

	Country	Happiness Rank	Year
2	Denmark	3	2015
3	Norway	4	2015
4	Canada	5	2015

	Country	Happiness Rank	Year
2	Iceland	3	2016
3	Norway	4	2016
4	Finland	5	2016

```
pd.merge(left=three_2015, right=three_2016, on="Country")
```

	Country	Happiness Rank_x	Year_x	Happiness Rank_y	Year_y
0	Norway	4	2015	4	2016

	Country	Happiness Rank	Year
2	Denmark	3	2015
3	Norway	4	2015
4	Canada	5	2015

	Country	Happiness Rank	Year
2	Iceland	3	2016
3	Norway	4	2016
4	Finland	5	2016

```
pd.merge(left=three_2015, right=three_2016, on='Country',how="left")
```

	Country	Happiness Rank_x	Year_x	Happiness Rank_y	Year_y
0	Denmark	3	2015	NaN	NaN
1	Norway	4	2015	4.0	2016.0
2	Canada	5	2015	NaN	NaN

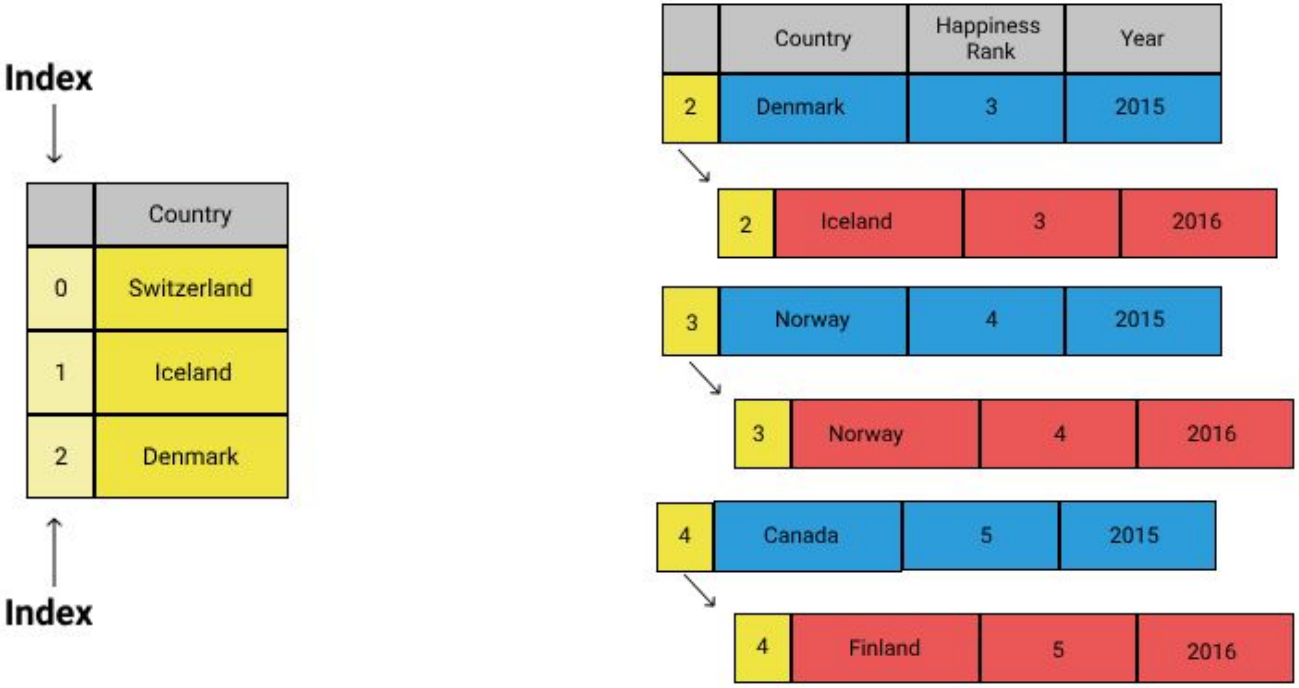
	Country	Happiness Rank	Year
2	Denmark	3	2015
3	Norway	4	2015
4	Canada	5	2015

	Country	Happiness Rank	Year
2	Iceland	3	2016
3	Norway	4	2016
4	Finland	5	2016

```
pd.merge(left=three_2015, right=three_2016,
         how='left', on='Country',suffixes=('_2015','_2016'))
```

	Country	Happiness Rank_2015	Year_2015	Happiness Rank_2016	Year_2016
0	Denmark	3	2015	NaN	NaN
1	Norway	4	2015	4.0	2016.0
2	Canada	5	2015	NaN	NaN

Join on index with merge function



	Country	Happiness Rank	Year
2	Denmark	3	2015
3	Norway	4	2015
4	Canada	5	2015
5	Finland	6	2015

	Country	Happiness Rank	Year
2	Iceland	3	2016
3	Norway	4	2016
4	Finland	5	2016

```
pd.merge(left = four_2015,right = three_2016,
                                left_index = True,
                                right_index = True,
                                suffixes = ('_2015','_2016'))
```

	Country_2015	Happiness Rank_2015	Year_2015	Country_2016	Happiness Rank_2016	Year_2016
2	Denmark	3	2015	Iceland	3	2016
3	Norway	4	2015	Norway	4	2016
4	Canada	5	2015	Finland	5	2016

	Country	Happiness Rank	Year
2	Denmark	3	2015
3	Norway	4	2015
4	Canada	5	2015
5	Finland	6	2015

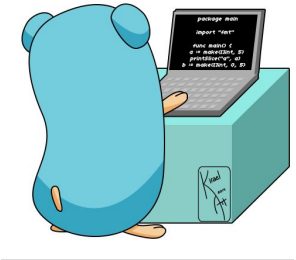
	Country	Happiness Rank	Year
2	Iceland	3	2016
3	Norway	4	2016
4	Finland	5	2016

```
pd.merge(left = four_2015, right = three_2016,
                    left_index = True, right_index = True,
                    how='left',
                    suffixes = ('_2015','_2016'))
```

	Country_2015	Happiness Rank_2015	Year_2015	Country_2016	Happiness Rank_2016	Year_2016
2	Denmark	3	2015	Iceland	3.0	2016.0
3	Norway	4	2015	Norway	4.0	2016.0
4	Canada	5	2015	Finland	5.0	2016.0
5	Finland	6	2015	NaN	NaN	NaN

	pd.concat()	pd.merge()
Default Join Type	Outer	Inner
Can Combine More Than Two Dataframes at a Time?	Yes	No
Can Combine Dataframes Vertically (axis=0) or Horizontally (axis=1)?	Both	Horizontally
Syntax	**Concat (Vertically)** concat([df1,df2,df3]) **Concat (Horizontally)** concat([df1,df2,df3], axis = 1)	**Merge (Join on Columns)** merge(left = df1, right = df2, how = 'join_type', on = 'Col') **Merge (Join on Index)** merge(left = df1, right = df2, how = 'join_type', left_index = True, right_index = True)

Did world happiness increase, decrease, or stay about the same from 2015 to 2017?



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