AI基础：Pandas简易入门

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以下文章来源于光城，作者lightcity

光城

本公众号旨在推送一些个人学习c++、python的一些历程，包括python爬虫，机器学...

Pandas 简易入门

0.导语

pandas 是基于 NumPy 的一种工具，该工具是为了解决数据分析任务而创建的。Pandas 纳入了大量库和一些标准的数据模型，提供了高效地操作大型数据集所需的工具。pandas 提供了大量能使我们快速便捷地处理数据的函数和方法。你很快就会发现，它是使 Python 成为强大而高效的数据分析环境的重要因素之一。

在此之前，我已经写了一篇Numpy的快速入门：

AI基础：Numpy简易入门，建议先看这篇。

接下来怎么快速入门Pandas?

先完整运行本文的代码，预计用一天时间就够了，再尝试完成这篇文章的代码：

Pandas 练习题-提高你的数据分析技能，巩固下。

接着呢？可以练习这篇文章的代码：

学完可以解决 90%以上的数据分析问题-利用 python 进行数据分析第二版（代码和中文笔记），

有了前面的基础，看起来会非常快，这个时候，pandas的基本操作都会了。

备注：本文代码可以在github下载

https://github.com/fengdu78/Data-Science-Notes/tree/master/3.pandas

1.Series

```
import pandas as pd
```

```
import numpy as np

# Series
s = pd.Series([1,3,6,np.nan,44,1])
print(s)
# 默认index从0开始,如果想要按照自己的索引设置，则修改index参数,如:index=[3,4,3,7,8,9]
```

```
0     1.0
1     3.0
2     6.0
3     NaN
4    44.0
5     1.0
dtype: float64
```

2.DataFrame

2.1 DataFrame 的简单运用

```
# DataFrame
dates = pd.date_range('2018-08-19',periods=6)
# dates = pd.date_range('2018-08-19','2018-08-24') # 起始、结束  与上述等价
'''
numpy.random.randn(d0, d1, …, dn)是从标准正态分布中返回一个或多个样本值。
numpy.random.rand(d0, d1, …, dn)的随机样本位于[0, 1)中。
(6,4)表示6行4列数据
'''
df = pd.DataFrame(np.random.randn(6,4),index=dates,columns=['a','b','c','d'])
print(df)
# DataFrame既有行索引也有列索引，  它可以被看做由Series组成的大字典。
```

```
                   a         b         c         d
2018-08-19  0.090400 -0.029562 -2.004038  2.686679
2018-08-20 -0.531038 -0.750023  0.662672  1.637006
2018-08-21 -1.040762 -0.005521 -0.531630  0.192298
2018-08-22 -0.388458  0.456383  0.412524  1.918840
2018-08-23  0.446538  1.062472  1.179866 -0.725910
2018-08-24  2.828722  1.234659  1.251329  0.620756
```

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

```
2018-08-19   -0.029562
2018-08-20   -0.750023
2018-08-21   -0.005521
```

```
2018-08-22    0.456383
2018-08-23    1.062472
2018-08-24    1.234659
Freq: D, Name: b, dtype: float64
```

```
# 未指定行标签和列标签的数据
df1 = pd.DataFrame(np.arange(12).reshape(3,4))
print(df1)
```

```
   0  1   2   3
0  0  1   2   3
1  4  5   6   7
2  8  9  10  11
```

```
# 另一种方式
df2 = pd.DataFrame({
    'A': [1,2,3,4],
    'B': pd.Timestamp('20180819'),
    'C': pd.Series([1,6,9,10],dtype='float32'),
    'D': np.array([3] * 4,dtype='int32'),
    'E': pd.Categorical(['test','train','test','train']),
    'F': 'foo'
})
print(df2)
```

```
   A          B     C  D      E    F
0  1 2018-08-19   1.0  3   test  foo
1  2 2018-08-19   6.0  3  train  foo
2  3 2018-08-19   9.0  3   test  foo
3  4 2018-08-19  10.0  3  train  foo
```

```
print(df2.index)
```

```
RangeIndex(start=0, stop=4, step=1)
```

```
print(df2.columns)
```

```
Index(['A', 'B', 'C', 'D', 'E', 'F'], dtype='object')
```

```
print(df2.values)
```

```
[[1 Timestamp('2018-08-19 00:00:00') 1.0 3 'test' 'foo']
 [2 Timestamp('2018-08-19 00:00:00') 6.0 3 'train' 'foo']
 [3 Timestamp('2018-08-19 00:00:00') 9.0 3 'test' 'foo']
 [4 Timestamp('2018-08-19 00:00:00') 10.0 3 'train' 'foo']]
```

```
# 数据总结
```

```
print(df2.describe())
```

```
              A          C    D
count  4.000000   4.000000  4.0
mean   2.500000   6.500000  3.0
std    1.290994   4.041452  0.0
min    1.000000   1.000000  3.0
25%    1.750000   4.750000  3.0
50%    2.500000   7.500000  3.0
75%    3.250000   9.250000  3.0
max    4.000000  10.000000  3.0
```

```
# 翻转数据
print(df2.T)
# print(np.transpose(df2))等价于上述操作
```

```
                    0                   1                   2  \
A                   1                   2                   3
B  2018-08-19 00:00:00  2018-08-19 00:00:00  2018-08-19 00:00:00
C                   1                   6                   9
D                   3                   3                   3
E                test               train                test
F                 foo                 foo                 foo

                    3
A                   4
B  2018-08-19 00:00:00
C                  10
D                   3
E               train
F                 foo
```

```
'''
axis=1表示行
axis=0表示列
默认ascending(升序)为True
ascending=True表示升序,ascending=False表示降序
下面两行分别表示按行升序与按行降序
'''
print(df2.sort_index(axis=1,ascending=True))
```

```
   A          B     C  D      E    F
0  1 2018-08-19   1.0  3   test  foo
1  2 2018-08-19   6.0  3  train  foo
2  3 2018-08-19   9.0  3   test  foo
3  4 2018-08-19  10.0  3  train  foo
```

```
print(df2.sort_index(axis=1,ascending=False))
```

```
     F      E  D     C          B  A
0  foo   test  3   1.0 2018-08-19  1
1  foo  train  3   6.0 2018-08-19  2
2  foo   test  3   9.0 2018-08-19  3
3  foo  train  3  10.0 2018-08-19  4
```

```
# 表示按列降序与按列升序
print(df2.sort_index(axis=0,ascending=False))
```

```
   A          B     C  D      E    F
3  4 2018-08-19  10.0  3  train  foo
2  3 2018-08-19   9.0  3   test  foo
1  2 2018-08-19   6.0  3  train  foo
0  1 2018-08-19   1.0  3   test  foo
```

```
print(df2.sort_index(axis=0,ascending=True))
```

```
   A          B     C  D      E    F
0  1 2018-08-19   1.0  3   test  foo
1  2 2018-08-19   6.0  3  train  foo
2  3 2018-08-19   9.0  3   test  foo
3  4 2018-08-19  10.0  3  train  foo
```

```
# 对特定列数值排列
# 表示对C列降序排列
print(df2.sort_values(by='C',ascending=False))
```

```
   A          B     C  D      E    F
3  4 2018-08-19  10.0  3  train  foo
2  3 2018-08-19   9.0  3   test  foo
1  2 2018-08-19   6.0  3  train  foo
0  1 2018-08-19   1.0  3   test  foo
```

3.pandas 选择数据

3.1 实战筛选

```
import pandas as pd
import numpy as np
dates = pd.date_range('20180819', periods=6)
df = pd.DataFrame(np.arange(24).reshape((6,4)),index=dates, columns=['A','B','C','D'])
print(df)
```

```
             A   B   C   D
```

```
2018-08-19   0   1   2   3
2018-08-20   4   5   6   7
2018-08-21   8   9  10  11
2018-08-22  12  13  14  15
2018-08-23  16  17  18  19
2018-08-24  20  21  22  23
```

```
# 检索A列
print(df['A'])
```

```
2018-08-19     0
2018-08-20     4
2018-08-21     8
2018-08-22    12
2018-08-23    16
2018-08-24    20
Freq: D, Name: A, dtype: int32
```

```
print(df.A)
```

```
2018-08-19     0
2018-08-20     4
2018-08-21     8
2018-08-22    12
2018-08-23    16
2018-08-24    20
Freq: D, Name: A, dtype: int32
```

```
# 选择跨越多行或多列
# 选取前3行
print(df[0:3])
```

```
            A  B   C   D
2018-08-19  0  1   2   3
2018-08-20  4  5   6   7
2018-08-21  8  9  10  11
```

```
print(df['2018-08-19':'2018-08-21'])
```

```
            A  B   C   D
2018-08-19  0  1   2   3
2018-08-20  4  5   6   7
2018-08-21  8  9  10  11
```

```
# 根据标签选择数据
# 获取特定行或列
# 指定行数据
print(df.loc['20180819'])
```

```
A    0
B    1
C    2
D    3
Name: 2018-08-19 00:00:00, dtype: int32
```

```
# 指定列
# 两种方式
print(df.loc[:,'A':'C'])
```

```
             A   B   C
2018-08-19   0   1   2
2018-08-20   4   5   6
2018-08-21   8   9  10
2018-08-22  12  13  14
2018-08-23  16  17  18
2018-08-24  20  21  22
```

```
print(df.loc[:,['A','C']])
```

```
             A   C
2018-08-19   0   2
2018-08-20   4   6
2018-08-21   8  10
2018-08-22  12  14
2018-08-23  16  18
2018-08-24  20  22
```

```
# 行与列同时检索
print(df.loc['20180819',['A','B']])
```

```
A    0
B    1
Name: 2018-08-19 00:00:00, dtype: int32
```

```
# 根据序列iloc
# 获取特定位置的值
print(df.iloc[3,1])
```

```
13
```

```
print(df.iloc[3:5,1:3]) # 不包含末尾5或3，同列表切片
```

```
             B   C
2018-08-22  13  14
2018-08-23  17  18
```

```
# 跨行操作
print(df.iloc[[1,3,5],1:3])
```

```
             B   C
2018-08-20   5   6
2018-08-22  13  14
2018-08-24  21  22
```

```
# 混合选择
print(df.ix[:3,['A','C']])
```

```
            A   C
2018-08-19  0   2
2018-08-20  4   6
2018-08-21  8  10
```

```
print(df.iloc[:3,[0,2]]) # 结果同上
```

```
            A   C
2018-08-19  0   2
2018-08-20  4   6
2018-08-21  8  10
```

```
# 通过判断的筛选
print(df[df.A>8])
```

```
             A   B   C   D
2018-08-22  12  13  14  15
2018-08-23  16  17  18  19
2018-08-24  20  21  22  23
```

```
# 通过判断的筛选
print(df.loc[df.A>8])
```

```
             A   B   C   D
2018-08-22  12  13  14  15
2018-08-23  16  17  18  19
2018-08-24  20  21  22  23
```

- 3.2 筛选总结

1.iloc 与 ix 区别

总结:相同点：iloc 可以取相应的值，操作方便,与 ix 操作类似。

不同点：ix 可以混合选择，可以填入 column 对应的字符选择，而 iloc 只能采用 index 索引，对于列数较多情况下，ix 要方便操作许多。

2.loc 与 iloc 区别

总结：相同点：都可以索引处块数据

不同点：iloc 可以检索对应值,两者操作不同。

3.ix 与 loc、iloc 三者的区别

n 总结：ix 是混合 loc 与 iloc 操作

如下:对比三者操作,输出结果相同

```
print(df.loc['20180819','A':'B'])
print(df.iloc[0,0:2])
print(df.ix[0,'A':'B'])
```

```
A    0
B    1
Name: 2018-08-19 00:00:00, dtype: int32
A    0
B    1
Name: 2018-08-19 00:00:00, dtype: int32
A    0
B    1
Name: 2018-08-19 00:00:00, dtype: int32
```

4.Pandas 设置值

4.1 创建数据

```
import pandas as pd
import numpy as np
# 创建数据
dates = pd.date_range('20180820',periods=6)
df = pd.DataFrame(np.arange(24).reshape(6,4), index=dates, columns=['A','B','C','D'])
print(df)
```

```
             A   B   C   D
2018-08-20   0   1   2   3
2018-08-21   4   5   6   7
2018-08-22   8   9  10  11
2018-08-23  12  13  14  15
2018-08-24  16  17  18  19
2018-08-25  20  21  22  23
```

4.2 根据位置设置 loc 和 iloc

```
# 根据位置设置loc和iloc
df.iloc[2,2] = 111
df.loc['20180820','B'] = 2222
print(df)
```

```
             A     B    C   D
2018-08-20   0  2222    2   3
2018-08-21   4     5    6   7
2018-08-22   8     9  111  11
2018-08-23  12    13   14  15
2018-08-24  16    17   18  19
2018-08-25  20    21   22  23
```

4.3 根据条件设置

```
# 根据条件设置
# 更改B中的数，而更改的位置取决于A的位置，并设相应位置的数为0
df.B[df.A>4] = 0
print(df)
```

```
             A     B    C   D
2018-08-20   0  2222    2   3
2018-08-21   4     5    6   7
2018-08-22   8     0  111  11
2018-08-23  12     0   14  15
2018-08-24  16     0   18  19
2018-08-25  20     0   22  23
```

```
df.B.loc[df.A>4] = 0
print(df)
```

```
             A     B    C   D
2018-08-20   0  2222    2   3
2018-08-21   4     5    6   7
2018-08-22   8     0  111  11
2018-08-23  12     0   14  15
2018-08-24  16     0   18  19
2018-08-25  20     0   22  23
```

4.4 按行或列设置

```
# 按行或列设置
# 列批处理，F列全改为NaN
df['F'] = np.nan
print(df)
```

```
             A     B    C   D   F
2018-08-20   0  2222    2   3 NaN
2018-08-21   4     5    6   7 NaN
2018-08-22   8     0  111  11 NaN
2018-08-23  12     0   14  15 NaN
2018-08-24  16     0   18  19 NaN
2018-08-25  20     0   22  23 NaN
```

4.5 添加 Series 序列(长度必须对齐)

```
df['E'] = pd.Series([1,2,3,4,5,6], index=pd.date_range('20180820',periods=6))
print(df)
```

```
             A     B    C   D   F  E
2018-08-20   0  2222    2   3 NaN  1
2018-08-21   4     5    6   7 NaN  2
2018-08-22   8     0  111  11 NaN  3
2018-08-23  12     0   14  15 NaN  4
2018-08-24  16     0   18  19 NaN  5
2018-08-25  20     0   22  23 NaN  6
```

4.6 设定某行某列为特定值

```
# 设定某行某列为特定值
df.ix['20180820','A'] = 56
print(df)
#ix 以后要剥离了，尽量不要用了
```

```
             A     B    C   D   F  E
2018-08-20  56  2222    2   3 NaN  1
2018-08-21   4     5    6   7 NaN  2
2018-08-22   8     0  111  11 NaN  3
2018-08-23  12     0   14  15 NaN  4
2018-08-24  16     0   18  19 NaN  5
2018-08-25  20     0   22  23 NaN  6
```

```
df.loc['20180820','A'] = 67
print(df)
```

```
             A     B    C   D   F  E
2018-08-20  67  2222    2   3 NaN  1
2018-08-21   4     5    6   7 NaN  2
2018-08-22   8     0  111  11 NaN  3
2018-08-23  12     0   14  15 NaN  4
2018-08-24  16     0   18  19 NaN  5
2018-08-25  20     0   22  23 NaN  6
```

```
df.iloc[0,0] = 76
print(df)
```

```
             A     B    C   D   F  E
2018-08-20  76  2222    2   3 NaN  1
2018-08-21   4     5    6   7 NaN  2
2018-08-22   8     0  111  11 NaN  3
2018-08-23  12     0   14  15 NaN  4
2018-08-24  16     0   18  19 NaN  5
2018-08-25  20     0   22  23 NaN  6
```

4.7 修改一整行数据

```
# 修改一整行数据
df.iloc[1] = np.nan # df.iloc[1,:]=np.nan
print(df)
```

```
              A       B      C     D   F    E
2018-08-20  76.0  2222.0    2.0   3.0 NaN  1.0
2018-08-21   NaN     NaN    NaN   NaN NaN  NaN
```

```
2018-08-22   8.0     0.0  111.0  11.0 NaN  3.0
2018-08-23  12.0     0.0   14.0  15.0 NaN  4.0
2018-08-24  16.0     0.0   18.0  19.0 NaN  5.0
2018-08-25  20.0     0.0   22.0  23.0 NaN  6.0
```

```
df.loc['20180820'] = np.nan # df.loc['20180820,:']=np.nan
print(df)
```

```
              A    B      C     D   F    E
2018-08-20   NaN  NaN    NaN   NaN NaN  NaN
2018-08-21   NaN  NaN    NaN   NaN NaN  NaN
2018-08-22   8.0  0.0  111.0  11.0 NaN  3.0
2018-08-23  12.0  0.0   14.0  15.0 NaN  4.0
2018-08-24  16.0  0.0   18.0  19.0 NaN  5.0
2018-08-25  20.0  0.0   22.0  23.0 NaN  6.0
```

```
df.ix[2] = np.nan # df.ix[2,:]=np.nan
print(df)
```

```
              A    B     C     D   F    E
2018-08-20   NaN  NaN   NaN   NaN NaN  NaN
2018-08-21   NaN  NaN   NaN   NaN NaN  NaN
2018-08-22   NaN  NaN   NaN   NaN NaN  NaN
2018-08-23  12.0  0.0  14.0  15.0 NaN  4.0
2018-08-24  16.0  0.0  18.0  19.0 NaN  5.0
2018-08-25  20.0  0.0  22.0  23.0 NaN  6.0
```

```
df.ix['20180823'] = np.nan
print(df)
```

```
              A    B     C     D   F    E
2018-08-20   NaN  NaN   NaN   NaN NaN  NaN
2018-08-21   NaN  NaN   NaN   NaN NaN  NaN
2018-08-22   NaN  NaN   NaN   NaN NaN  NaN
2018-08-23   NaN  NaN   NaN   NaN NaN  NaN
2018-08-24  16.0  0.0  18.0  19.0 NaN  5.0
2018-08-25  20.0  0.0  22.0  23.0 NaN  6.0
```

5.Pandas 处理丢失数据

5.1 创建含 NaN 的矩阵

```
# Pandas处理丢失数据
import pandas as pd
import numpy as np
# 创建含NaN的矩阵
```

```
# 如何填充和删除NaN数据?
dates = pd.date_range('20180820',periods=6)
df = pd.DataFrame(np.arange(24).reshape((6,4)),index=dates,columns=['A','B','C','D'])
print(df)
```

```
             A   B   C   D
2018-08-20   0   1   2   3
2018-08-21   4   5   6   7
2018-08-22   8   9  10  11
2018-08-23  12  13  14  15
2018-08-24  16  17  18  19
2018-08-25  20  21  22  23
```

```
# a.reshape(6,4)等价于a.reshape((6,4))
df.iloc[0,1] = np.nan
df.iloc[1,2] = np.nan
print(df)
```

```
             A     B     C   D
2018-08-20   0   NaN   2.0   3
2018-08-21   4   5.0   NaN   7
2018-08-22   8   9.0  10.0  11
2018-08-23  12  13.0  14.0  15
2018-08-24  16  17.0  18.0  19
2018-08-25  20  21.0  22.0  23
```

5.2 删除掉有 NaN 的行或列

```
# 删除掉有NaN的行或列
print(df.dropna()) # 默认是删除掉含有NaN的行
```

```
             A     B     C   D
2018-08-22   8   9.0  10.0  11
2018-08-23  12  13.0  14.0  15
2018-08-24  16  17.0  18.0  19
2018-08-25  20  21.0  22.0  23
```

```
print(df.dropna(
    axis=0, # 0对行进行操作;1对列进行操作
    how='any' # 'any':只要存在NaN就drop掉; 'all':必须全部是NaN才drop
))
```

```
             A     B     C   D
2018-08-22   8   9.0  10.0  11
2018-08-23  12  13.0  14.0  15
```

```
2018-08-24  16  17.0  18.0  19
2018-08-25  20  21.0  22.0  23
```

```
# 删除掉所有含有NaN的列
print(df.dropna(
    axis=1,
    how='any'
))
```

```
            A   D
2018-08-20  0   3
2018-08-21  4   7
2018-08-22  8  11
2018-08-23 12  15
2018-08-24 16  19
2018-08-25 20  23
```

5.3 替换 NaN 值为 0 或者其他

```
# 替换NaN值为0或者其他
print(df.fillna(value=0))
```

```
            A     B     C   D
2018-08-20  0   0.0   2.0   3
2018-08-21  4   5.0   0.0   7
2018-08-22  8   9.0  10.0  11
2018-08-23 12  13.0  14.0  15
2018-08-24 16  17.0  18.0  19
2018-08-25 20  21.0  22.0  23
```

5.4 是否有缺失数据 NaN

```
# 是否有缺失数据NaN
# 是否为空
print(df.isnull())
```

```
               A      B      C      D
2018-08-20  False   True  False  False
2018-08-21  False  False   True  False
2018-08-22  False  False  False  False
2018-08-23  False  False  False  False
2018-08-24  False  False  False  False
2018-08-25  False  False  False  False
```

```
# 是否为NaN
```

```
print(df.isna())
```

```
                A      B      C      D
2018-08-20  False   True  False  False
2018-08-21  False  False   True  False
2018-08-22  False  False  False  False
2018-08-23  False  False  False  False
2018-08-24  False  False  False  False
2018-08-25  False  False  False  False
```

```
# 检测某列是否有缺失数据NaN
print(df.isnull().any())
```

```
A    False
B     True
C     True
D    False
dtype: bool
```

```
# 检测数据中是否存在NaN,如果存在就返回True
print(np.any(df.isnull())==True)
```

```
True
```

6.Pandas 导入导出

6.1 导入数据

```
import pandas as pd # 加载模块
# 读取csv
data = pd.read_csv('student.csv')
# 打印出data
print(data)
```

```
    Student ID  name   age  gender
0         1100  Kelly   22  Female
1         1101    Clo   21  Female
2         1102  Tilly   22  Female
3         1103   Tony   24    Male
4         1104  David   20    Male
5         1105  Catty   22  Female
6         1106      M    3  Female
7         1107      N   43    Male
8         1108      A   13    Male
9         1109      S   12    Male
10        1110  David   33    Male
```

```
11         1111     Dw     3  Female
12         1112      Q    23    Male
13         1113      W    21  Female
```

```
# 前三行
print(data.head(3))
```

```
   Student ID  name   age  gender
0        1100  Kelly   22  Female
1        1101    Clo   21  Female
2        1102  Tilly   22  Female
```

```
# 后三行
print(data.tail(3))
```

```
    Student ID name   age  gender
11         1111    Dw     3  Female
12         1112     Q    23    Male
13         1113     W    21  Female
```

6.2 导出数据

```
# 将资料存取成pickle
data.to_pickle('student.pickle')
```

```
# 读取pickle文件并打印
print(pd.read_pickle('student.pickle'))
```

```
    Student ID  name   age  gender
0         1100  Kelly   22  Female
1         1101    Clo   21  Female
2         1102  Tilly   22  Female
3         1103   Tony   24    Male
4         1104  David   20    Male
5         1105  Catty   22  Female
6         1106      M    3  Female
7         1107      N   43    Male
8         1108      A   13    Male
9         1109      S   12    Male
10        1110  David   33    Male
11        1111     Dw    3  Female
12        1112      Q   23    Male
13        1113      W   21  Female
```

7.Pandas 合并操作

7.1 Pandas 合并 concat

```
import pandas as pd
import numpy as np

# 定义资料集
df1 = pd.DataFrame(np.ones((3,4))*0, columns=['a','b','c','d'])
df2 = pd.DataFrame(np.ones((3,4))*1, columns=['a','b','c','d'])
df3 = pd.DataFrame(np.ones((3,4))*2, columns=['a','b','c','d'])
print(df1)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
```

```
print(df2)
```

```
     a    b    c    d
0  1.0  1.0  1.0  1.0
1  1.0  1.0  1.0  1.0
2  1.0  1.0  1.0  1.0
```

```
print(df3)
```

```
     a    b    c    d
0  2.0  2.0  2.0  2.0
1  2.0  2.0  2.0  2.0
2  2.0  2.0  2.0  2.0
```

```
# concat纵向合并
res = pd.concat([df1,df2,df3],axis=0)

# 打印结果
print(res)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
0  1.0  1.0  1.0  1.0
1  1.0  1.0  1.0  1.0
2  1.0  1.0  1.0  1.0
0  2.0  2.0  2.0  2.0
1  2.0  2.0  2.0  2.0
2  2.0  2.0  2.0  2.0
```

```
# 上述合并过程中，index重复，下面给出重置index方法
# 只需要将index_ignore设定为True即可
res = pd.concat([df1,df2,df3],axis=0,ignore_index=True)

# 打印结果
print(res)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
5  1.0  1.0  1.0  1.0
6  2.0  2.0  2.0  2.0
7  2.0  2.0  2.0  2.0
8  2.0  2.0  2.0  2.0
```

```
# join 合并方式
#定义资料集
df1 = pd.DataFrame(np.ones((3,4))*0, columns=['a','b','c','d'], index=[1,2,3])
df2 = pd.DataFrame(np.ones((3,4))*1, columns=['b','c','d','e'], index=[2,3,4])
print(df1)
```

```
     a    b    c    d
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  0.0  0.0  0.0  0.0
```

```
print(df2)
```

```
     b    c    d    e
2  1.0  1.0  1.0  1.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
```

```
'''
join='outer',函数默认为join='outer'。此方法是依照column来做纵向合并，有相同的column上下合并在一起，
其他独自的column各自成列，原来没有值的位置皆为NaN填充。
'''
# 纵向"外"合并df1与df2
res = pd.concat([df1,df2],axis=0,join='outer')

print(res)
```

```
     a    b    c    d    e
1  0.0  0.0  0.0  0.0  NaN
```

```
2  0.0  0.0  0.0  0.0  NaN
3  0.0  0.0  0.0  0.0  NaN
2  NaN  1.0  1.0  1.0  1.0
3  NaN  1.0  1.0  1.0  1.0
4  NaN  1.0  1.0  1.0  1.0
```

```
# 修改index
res = pd.concat([df1,df2],axis=0,join='outer',ignore_index=True)

print(res)
```

```
     a    b    c    d    e
0  0.0  0.0  0.0  0.0  NaN
1  0.0  0.0  0.0  0.0  NaN
2  0.0  0.0  0.0  0.0  NaN
3  NaN  1.0  1.0  1.0  1.0
4  NaN  1.0  1.0  1.0  1.0
5  NaN  1.0  1.0  1.0  1.0
```

```
# join='inner'合并相同的字段
# 纵向"内"合并df1与df2
res = pd.concat([df1,df2],axis=0,join='inner')
# 打印结果
print(res)
```

```
     b    c    d
1  0.0  0.0  0.0
2  0.0  0.0  0.0
3  0.0  0.0  0.0
2  1.0  1.0  1.0
3  1.0  1.0  1.0
4  1.0  1.0  1.0
```

```
# join_axes(依照axes合并)
#定义资料集
df1 = pd.DataFrame(np.ones((3,4))*0, columns=['a','b','c','d'], index=[1,2,3])
df2 = pd.DataFrame(np.ones((3,4))*1, columns=['b','c','d','e'], index=[2,3,4])
print(df1)
```

```
     a    b    c    d
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  0.0  0.0  0.0  0.0
```

```
print(df2)
```

```
     b    c    d    e
2  1.0  1.0  1.0  1.0
```

```
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
```

```
# 依照df1.index进行横向合并
res = pd.concat([df1,df2],axis=1,join_axes=[df1.index])
print(res)
```

```
     a    b    c    d    b    c    d    e
1  0.0  0.0  0.0  0.0  NaN  NaN  NaN  NaN
2  0.0  0.0  0.0  0.0  1.0  1.0  1.0  1.0
3  0.0  0.0  0.0  0.0  1.0  1.0  1.0  1.0
```

```
# 移除join_axes参数,打印结果
res = pd.concat([df1,df2],axis=1)
print(res)
```

```
     a    b    c    d    b    c    d    e
1  0.0  0.0  0.0  0.0  NaN  NaN  NaN  NaN
2  0.0  0.0  0.0  0.0  1.0  1.0  1.0  1.0
3  0.0  0.0  0.0  0.0  1.0  1.0  1.0  1.0
4  NaN  NaN  NaN  NaN  1.0  1.0  1.0  1.0
```

```
# append(添加数据)
# append只有纵向合并，没有横向合并
#定义资料集
df1 = pd.DataFrame(np.ones((3,4))*0, columns=['a','b','c','d'])
df2 = pd.DataFrame(np.ones((3,4))*1, columns=['a','b','c','d'])
df3 = pd.DataFrame(np.ones((3,4))*2, columns=['a','b','c','d'])
s1 = pd.Series([1,2,3,4], index=['a','b','c','d'])
# 将df2合并到df1下面,以及重置index,并打印出结果
res = df1.append(df2,ignore_index=True)
print(res)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
5  1.0  1.0  1.0  1.0
```

```
# 合并多个df,将df2与df3合并至df1的下面,以及重置index,并打印出结果
res = df1.append([df2,df3], ignore_index=True)
print(res)
```

```
     a    b    c    d
```

```
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
5  1.0  1.0  1.0  1.0
6  2.0  2.0  2.0  2.0
7  2.0  2.0  2.0  2.0
8  2.0  2.0  2.0  2.0
```

```
# 合并series,将s1合并至df1，以及重置index，并打印结果
res = df1.append(s1,ignore_index=True)
print(res)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  2.0  3.0  4.0
```

```
# 总结:两种常用合并方式
res = pd.concat([df1, df2, df3], axis=0, ignore_index=True)
res1 = df1.append([df2, df3], ignore_index=True)
print(res)
print(res1)
```

```
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
5  1.0  1.0  1.0  1.0
6  2.0  2.0  2.0  2.0
7  2.0  2.0  2.0  2.0
8  2.0  2.0  2.0  2.0
     a    b    c    d
0  0.0  0.0  0.0  0.0
1  0.0  0.0  0.0  0.0
2  0.0  0.0  0.0  0.0
3  1.0  1.0  1.0  1.0
4  1.0  1.0  1.0  1.0
5  1.0  1.0  1.0  1.0
6  2.0  2.0  2.0  2.0
7  2.0  2.0  2.0  2.0
8  2.0  2.0  2.0  2.0
```

7.2.Pandas 合并 merge

7.2.1 定义资料集并打印出

```
import pandas as pd
# 依据一组key合并
# 定义资料集并打印出
left = pd.DataFrame({'key' : ['K0','K1','K2','K3'],
                     'A' : ['A0','A1','A2','A3'],
                     'B' : ['B0','B1','B2','B3']})

right = pd.DataFrame({'key': ['K0', 'K1', 'K2', 'K3'],
                      'C' : ['C0', 'C1', 'C2', 'C3'],
                      'D' : ['D0', 'D1', 'D2', 'D3']})
print(left)
```

```
    A   B key
0  A0  B0  K0
1  A1  B1  K1
2  A2  B2  K2
3  A3  B3  K3
```

```
print(right)
```

```
    C   D key
0  C0  D0  K0
1  C1  D1  K1
2  C2  D2  K2
3  C3  D3  K3
```

7.2.2 依据 key column 合并,并打印

```
# 依据key column合并,并打印
res = pd.merge(left,right,on='key')
print(res)
```

```
    A   B key   C   D
0  A0  B0  K0  C0  D0
1  A1  B1  K1  C1  D1
2  A2  B2  K2  C2  D2
3  A3  B3  K3  C3  D3
```

```
#  依据两组key合并
#定义资料集并打印出
left = pd.DataFrame({'key1': ['K0', 'K0', 'K1', 'K2'],
```

```
                        'key2': ['K0', 'K1', 'K0', 'K1'],
                        'A': ['A0', 'A1', 'A2', 'A3'],
                        'B': ['B0', 'B1', 'B2', 'B3']})
right = pd.DataFrame({'key1': ['K0', 'K1', 'K1', 'K2'],
                        'key2': ['K0', 'K0', 'K0', 'K0'],
                        'C': ['C0', 'C1', 'C2', 'C3'],
                        'D': ['D0', 'D1', 'D2', 'D3']})
print(left)
```

```
    A   B key1 key2
0  A0  B0   K0   K0
1  A1  B1   K0   K1
2  A2  B2   K1   K0
3  A3  B3   K2   K1
```

```
print(right)
```

```
    C   D key1 key2
0  C0  D0   K0   K0
1  C1  D1   K1   K0
2  C2  D2   K1   K0
3  C3  D3   K2   K0
```

7.2.3 两列合并

```
# 依据key1与key2 columns进行合并，并打印出四种结果['left', 'right', 'outer', 'inner']
res = pd.merge(left, right, on=['key1', 'key2'], how='inner')
print(res)
```

```
    A   B key1 key2   C   D
0  A0  B0   K0   K0  C0  D0
1  A2  B2   K1   K0  C1  D1
2  A2  B2   K1   K0  C2  D2
```

```
res = pd.merge(left, right, on=['key1', 'key2'], how='outer')
print(res)
```

```
     A    B key1 key2    C    D
0   A0   B0   K0   K0   C0   D0
1   A1   B1   K0   K1  NaN  NaN
2   A2   B2   K1   K0   C1   D1
3   A2   B2   K1   K0   C2   D2
4   A3   B3   K2   K1  NaN  NaN
5  NaN  NaN   K2   K0   C3   D3
```

```
res = pd.merge(left, right, on=['key1', 'key2'], how='left')
print(res)
```

```
    A   B key1 key2    C    D
0  A0  B0   K0   K0   C0   D0
1  A1  B1   K0   K1  NaN  NaN
2  A2  B2   K1   K0   C1   D1
3  A2  B2   K1   K0   C2   D2
4  A3  B3   K2   K1  NaN  NaN
```

```
res = pd.merge(left, right, on=['key1', 'key2'], how='right')
print(res)
```

```
     A    B key1 key2   C   D
0   A0   B0   K0   K0  C0  D0
1   A2   B2   K1   K0  C1  D1
2   A2   B2   K1   K0  C2  D2
3  NaN  NaN   K2   K0  C3  D3
```

7.2.4 Indicator 设置合并列名称

```
# Indicator
df1 = pd.DataFrame({'col1':[0,1],'col_left':['a','b']})
df2 = pd.DataFrame({'col1':[1,2,2],'col_right':[2,2,2]})
print(df1)
```

```
   col1 col_left
0     0        a
1     1        b
```

```
print(df2)
```

```
   col1  col_right
0     1          2
1     2          2
2     2          2
```

```
# 依据col1进行合并,并启用indicator=True,最后打印
res = pd.merge(df1,df2,on='col1',how='outer',indicator=True)
print(res)
```

```
   col1 col_left  col_right      _merge
0     0        a        NaN   left_only
1     1        b        2.0        both
2     2      NaN        2.0  right_only
3     2      NaN        2.0  right_only
```

```
# 自定义indicator column的名称,并打印出
res = pd.merge(df1,df2,on='col1',how='outer',indicator='indicator_column')
print(res)
```

```
   col1 col_left  col_right indicator_column
0     0        a        NaN        left_only
1     1        b        2.0             both
2     2      NaN        2.0       right_only
3     2      NaN        2.0       right_only
```

7.2.5 依据 index 合并

```
# 依据index合并
#定义资料集并打印出
left = pd.DataFrame({'A': ['A0', 'A1', 'A2'],
                     'B': ['B0', 'B1', 'B2']},
                     index=['K0', 'K1', 'K2'])
right = pd.DataFrame({'C': ['C0', 'C2', 'C3'],
                      'D': ['D0', 'D2', 'D3']},
                     index=['K0', 'K2', 'K3'])
print(left)
```

```
    A   B
K0  A0  B0
K1  A1  B1
K2  A2  B2
```

```
print(right)
```

```
    C   D
K0  C0  D0
K2  C2  D2
K3  C3  D3
```

```
# 依据左右资料集的index进行合并,how='outer',并打印
res = pd.merge(left,right,left_index=True,right_index=True,how='outer')
print(res)
```

```
     A    B    C    D
K0   A0   B0   C0   D0
K1   A1   B1  NaN  NaN
K2   A2   B2   C2   D2
K3  NaN  NaN   C3   D3
```

```

```

```
# 依据左右资料集的index进行合并,how='inner',并打印
res = pd.merge(left,right,left_index=True,right_index=True,how='inner')
print(res)
```

```
    A   B   C   D
K0  A0  B0  C0  D0
K2  A2  B2  C2  D2
```

7.2.6 解决 overlapping 的问题

```
# 解决overlapping的问题
#定义资料集
boys = pd.DataFrame({'k': ['K0', 'K1', 'K2'], 'age': [1, 2, 3]})
girls = pd.DataFrame({'k': ['K0', 'K0', 'K3'], 'age': [4, 5, 6]})
print(boys)
```

```
   age   k
0    1  K0
1    2  K1
2    3  K2
```

```
print(girls)
```

```
   age   k
0    4  K0
1    5  K0
2    6  K3
```

```
# 使用suffixes解决overlapping的问题
# 比如将上面两个合并时,age重复了,则可通过suffixes设置,以此保证不重复,不同名
res = pd.merge(boys,girls,on='k',suffixes=['_boy','_girl'],how='inner')
print(res)
```

```
   age_boy   k  age_girl
0        1  K0         4
1        1  K0         5
```

8.Pandas plot 出图

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

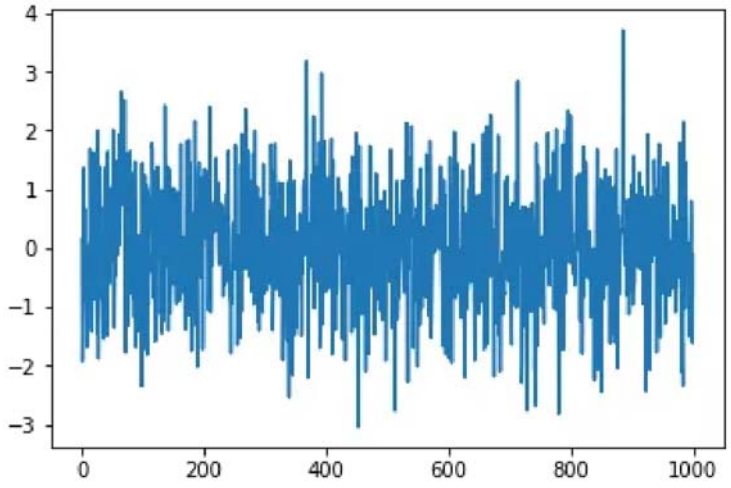
```
data = pd.Series(np.random.randn(1000), index=np.arange(1000))
print(data)
```

```
0      0.143408
1     -1.936116
2     -1.488609
中间数据略
998   -1.617468
999   -0.115447
Length: 1000, dtype: float64
```

```
print(data.cumsum())
```

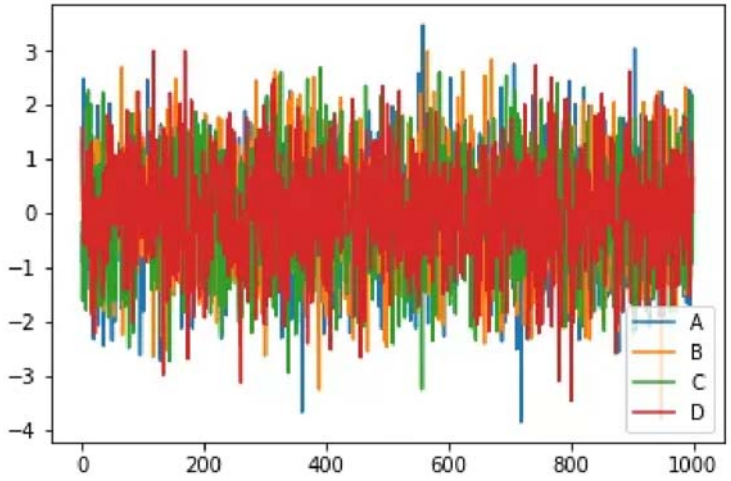
```
0       0.143408
1      -1.792708
2      -3.281317
中间数据略
997    19.760929
998    18.143460
999    18.028013
Length: 1000, dtype: float64
```

```
# data本来就是一个数据，所以我们可以直接plot
data.plot()
plt.show()
```

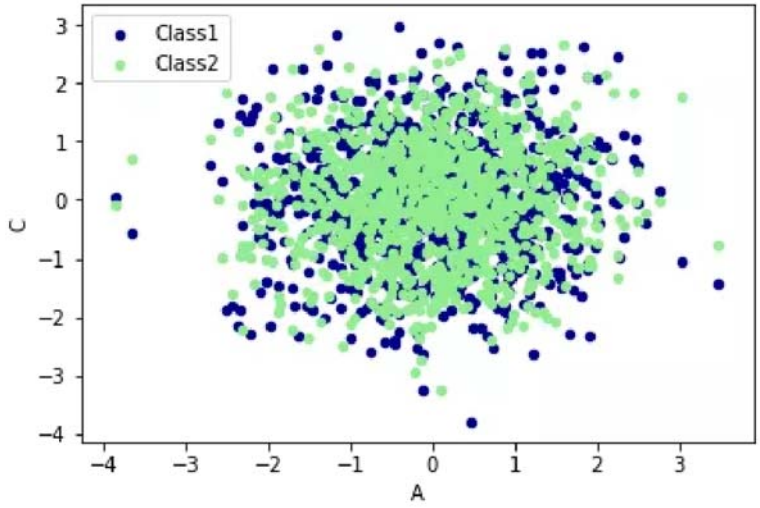



```
# np.random.randn(1000,4) 随机生成1000行4列数据
# list("ABCD")会变为['A','B','C','D']
data = pd.DataFrame(
    np.random.randn(1000,4),
    index=np.arange(1000),
    columns=list("ABCD")
)
data.cumsum()
```

```
data.plot()
plt.show()
```




```
ax = data.plot.scatter(x='A',y='B',color='DarkBlue',label='Class1')
# 将之下这个 data 画在上一个 ax 上面
data.plot.scatter(x='A',y='C',color='LightGreen',label='Class2',ax=ax)
plt.show()
```



9.学习来源

- 光城
- https://morvanzhou.github.io/tutorials/data-manipulation/np-pd/

备注：本文代码可以在github下载

https://github.com/fengdu78/Data-Science-Notes/tree/master/3.pandas

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