Chapter3

December 23, 2017

```
In [1]: import os
        import sys
        #os.chdir(os.path.expanduser("~") + "/book/ch03")
        import urllib
        from urllib.request import urlretrieve as ur
        import os.path
        """
        Listing 3-3
        URL for the AlienVault IP Reputation Database (OSSIM format)
        storing the URL in a variable makes it easier to modify later
        if it changes. NOTE: we are using a specific version of the data
        in these examples, so we are pulling it from an alternate
        book-specific location.
        """
```

```
Out[1]: '\nListing 3-3\nURL for the AlienVault IP Reputation Database (OSSIM format)\nstoring th
```

```
In [2]: avURL = "http://datadrivensecurity.info/book/ch03/data/reputation.data"
        # relative path for the downloaded data
        avRep = "../data/reputation.data"
```

using an if-wrapped test with urllib.urlretrieve() vs direct read via panads avoids having to re-download a 16MB file every time we run the script

```
In [3]: if not os.path.isfile(avRep):
            ur(avURL, filename=avRep)
```

```
In [4]: # Listing 3-5
        import pandas as pd
        # read in the data into a pandas data frame
        av = pd.read_csv(avRep, sep="#", header=None)
```

make smarter column names

```
In [5]: av.columns = ["IP","Reliability","Risk","Type","Country",
                     "Locale","Coords","x"]
```

```
In [6]: av.head()
```

```
Out[6]:                IP  Reliability  Risk           Type Country  Locale  \
        0  222.76.212.189            4     2  Scanning Host      CN  Xiamen
        1  222.76.212.185            4     2  Scanning Host      CN  Xiamen
        2  222.76.212.186            4     2  Scanning Host      CN  Xiamen
        3     5.34.246.67            6     3       Spamming      US     NaN
        4   178.94.97.176            4     5  Scanning Host      UA  Merefa

                            Coords   x
        0   24.4797992706,118.08190155  11
        1   24.4797992706,118.08190155  11
        2   24.4797992706,118.08190155  11
        3                38.0,-97.0  12
        4  49.8230018616,36.0507011414  11
```

Listing 3-6 require object: av (3-5) See corresponding output in Figure 3-1 import the capability to display Python objects as formatted HTML

```
In [7]: from IPython.display import HTML
        # display the first 10 lines of the dataframe as formatted HTML
        HTML(av.head(10).to_html())

Out[7]: <IPython.core.display.HTML object>
```

Listing 3-8
require object: av (3-5)

```
In [8]: av['Reliability'].describe()

Out[8]: count    258626.000000
        mean          2.798040
        std           1.130419
        min           1.000000
        25%           2.000000
        50%           2.000000
        75%           4.000000
        max          10.000000
        Name: Reliability, dtype: float64

In [9]: av['Risk'].describe()

Out[9]: count    258626.000000
        mean          2.221362
        std           0.531571
        min           1.000000
        25%           2.000000
        50%           2.000000
        75%           2.000000
        max           7.000000
        Name: Risk, dtype: float64
```

Listing 3-10
require object: av (3-5) factor_col(col)
helper function to mimic R's "summary()" function for pandas "columns" (which are really just Python arrays)

```
In [10]: def factor_col(col):
             factor = pd.Categorical.from_array(col)
             return pd.value_counts(factor,sort=True).reindex(factor.categories)

In [11]: rel_ct = pd.value_counts(av['Reliability'])
         risk_ct = pd.value_counts(av['Risk'])
         type_ct = pd.value_counts(av['Type'])
         country_ct = pd.value_counts(av['Country'])

In [12]: factor_col(av['Reliability'])

C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f



Out[12]: 1       5612
         2     149117
         3      10892
         4      87040
         5          7
         6       4758
         7        297
         8         21
         9        686
         10       196
         dtype: int64

In [13]: factor_col(av['Risk'])

C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f



Out[13]: 1        39
         2    213852
         3     33719
         4      9588
         5      1328
         6        90
         7        10
         dtype: int64

In [14]: factor_col(av['Type']).head(n=10)
```

```
C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f
```

```
Out[14]: APT;Malware Domain                 1
         C&C                              610
         C&C;Malware Domain                31
         C&C;Malware IP                    20
         C&C;Scanning Host                  7
         Malicious Host                  3770
         Malicious Host;Malware Domain      4
         Malicious Host;Malware IP          2
         Malicious Host;Scanning Host     163
         Malware Domain                  9274
         dtype: int64
```

```
In [15]: factor_col(av['Country']).head(n=10)
```

```
C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f
```

```
Out[15]: A1     267
         A2       2
         AE    1827
         AL       4
         AM       6
         AN       3
         AO     256
         AR    3046
         AT      51
         AU     155
         dtype: int64
```

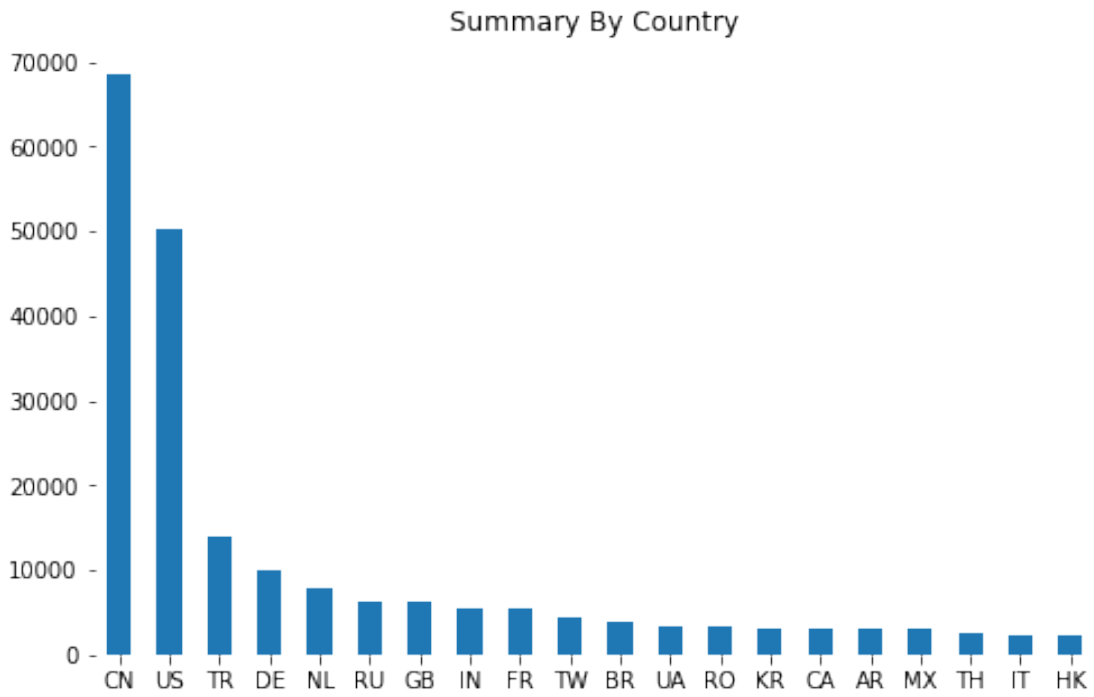
Listing 3-14 require object: av (3-5) See corresponding output in Figure 3-5

NOTE: Notice the significant differnce in the Python graph in that the blank/empty country code entries are not in the graph need some functions from matplotlib to help reduce 'chart junk'

```
In [16]: import matplotlib.pyplot as plt
         %matplotlib inline

         # sort by country
         country_ct = pd.value_counts(av['Country'])
```

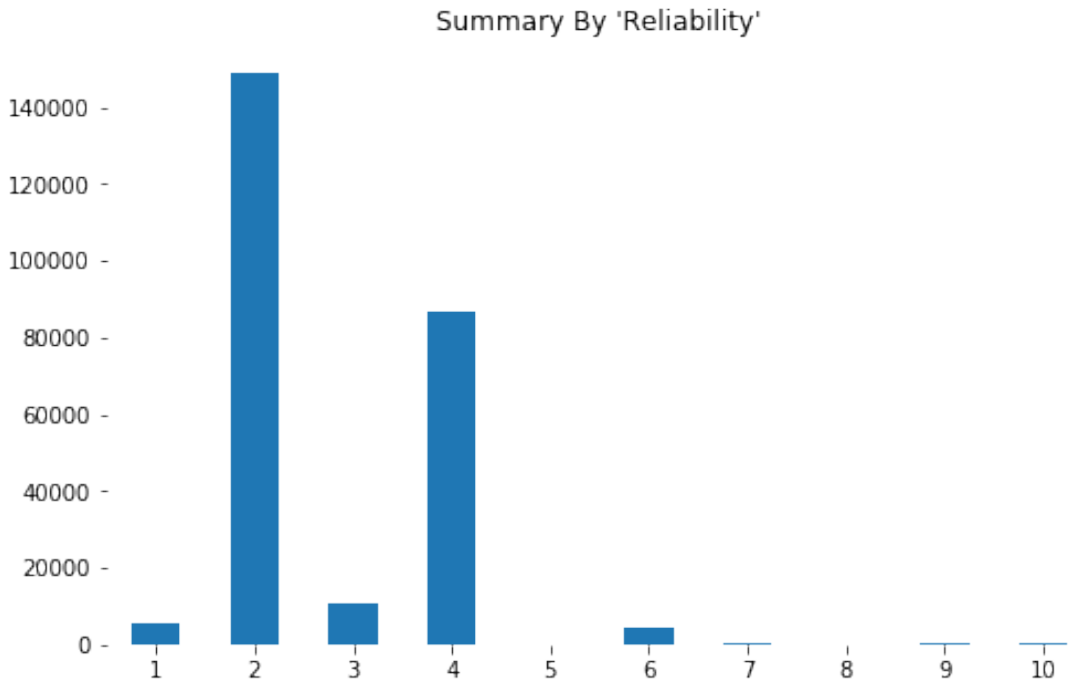
plot the data

```
In [17]: plt.axes(frameon=0) # reduce chart junk
         country_ct[:20].plot(kind='bar',
            rot=0, title="Summary By Country", figsize=(8,5)).grid(False)
```



Listing 3-15
requires packages: matplotlib
require object: av (3-5), factor_col (3-10)
See corresponding output in Figure 3-6

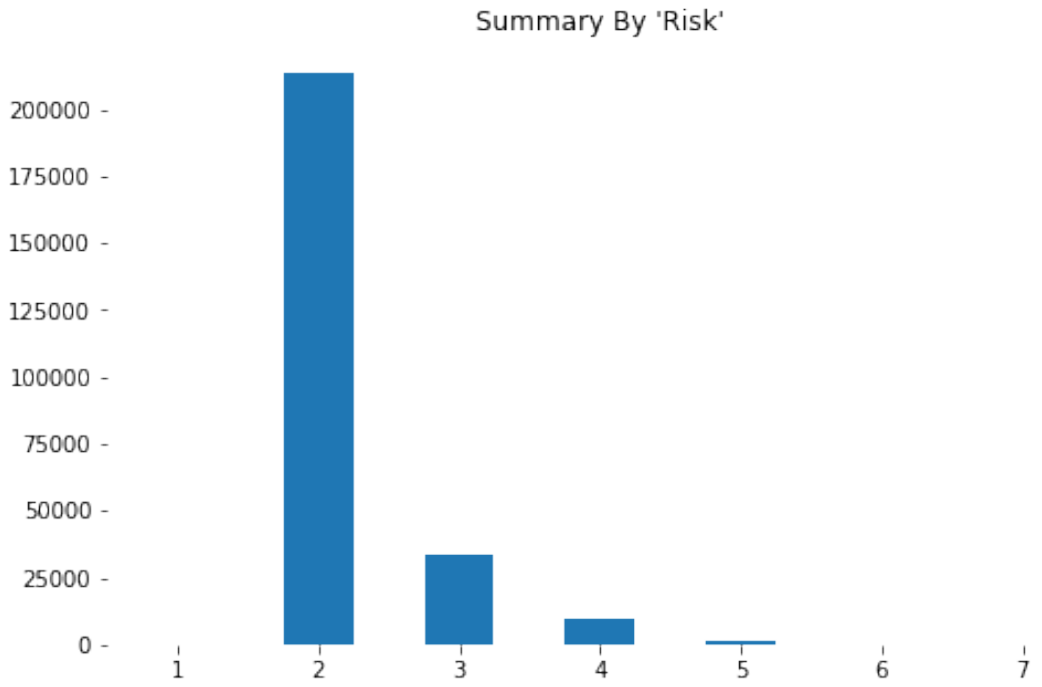
```
In [18]: plt.axes(frameon=0) # reduce chart junk
         factor_col(av['Reliability']).plot(kind='bar', rot=0,
                    title="Summary By 'Reliability'", figsize=(8,5)).grid(False)

C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f
```



Listing 3-16
requires packages: matplotlib
require object: av (3-5), factor_col (3-10)
See corresponding output in Figure 3-7

```
In [19]: plt.axes(frameon=0) # reduce chart junk
         factor_col(av['Risk']).plot(kind='bar', rot=0,
                    title="Summary By 'Risk'", figsize=(8,5)).grid(False)
```

```
C:\Users\Ripti\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: Categorical.f
```



Listing 3-18
require object: av (3-5)
extract the top 10 most prevalent countries

```
In [20]: top10 = pd.value_counts(av['Country'])[0:9]
         # calculate the % for each of the top 10
         top10.astype(float) / len(av['Country'])
```

```
Out[20]: CN    0.265182
         US    0.194826
         TR    0.053970
         DE    0.038484
         NL    0.030666
         RU    0.024537
         GB    0.024332
         IN    0.021189
         FR    0.021069
         Name: Country, dtype: float64
```

Listing 3-20
require object: av (3-5)
compute contingency table for Risk/Reliability factors which produces a matrix of counts of rows that have attributes at each (x, y) location need cm for basic colors need arange to modify axes display

```
In [21]: from matplotlib import cm
         from numpy import arange
         print(pd.crosstab(av['Risk'], av['Reliability']).to_string())
```

Reliability	1	2	3	4	5	6	7	8	9	10
Risk										
1	0	0	16	7	0	8	8	0	0	0
2	804	149114	3670	57653	4	2084	85	11	345	82
3	2225	3	6668	22168	2	2151	156	7	260	79
4	2129	0	481	6447	0	404	43	2	58	24
5	432	0	55	700	1	103	5	1	20	11
6	19	0	2	60	0	8	0	0	1	0
7	3	0	0	5	0	0	0	0	2	0

graphical view of contingency table (swapping risk/reliability)

```
In [22]: xtab = pd.crosstab(av['Reliability'], av['Risk'])
         plt.pcolor(xtab,cmap=cm.Greens)
         plt.yticks(arange(0.5,len(xtab.index), 1),xtab.index)
         plt.xticks(arange(0.5,len(xtab.columns), 1),xtab.columns)
         plt.colorbar()
         plt.title("Risk ~ Reliability")

Out[22]: Text(0.5,1,'Risk ~ Reliability')
```