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msalloum adding labs 1, 4, 5, 6 d160664 on Aug 8

1 contributor

```
1159 lines (1158 sloc)   76.4 KB
```

Exploratory Data Analysis

The HOUSES dataset contains a collection of recent real estate listings in San Luis Obispo county and around it. The dataset is as a CSV file. The dataset contains the following fields:

1. MLS: Multiple listing service number for the house (unique ID).
2. Location: city/town where the house is located. Most locations are in San Luis Obispo county and northern Santa Barbara county (Santa Maria-Orcutt, Lompoc, Guadelupe, Los Alamos), but there some out of area locations as well.
3. Price: the most recent listing price of the house (in dollars).
4. Bedrooms: number of bedrooms.
5. Bathrooms: number of bathrooms.
6. Size: size of the house in square feet.
7. Price/SQ.ft: price of the house per square foot.
8. Status: type of sale. Thee types are represented in the dataset: Short Sale, Foreclosure and Regular.

Lets import the required libraries that we will be using later.

```
In [2]: from numpy import *
        import pandas as pd
```

Let's load the dataset into a pandas dataframe and have a look at the headers.

```
In [3]: df = pd.read_csv('data.csv', sep=',', error_bad_lines=False) # read fie as a dataframe

        print len(df)    # print number of rows
        print list(df)   # print 1st ten headers

        781
        ['MLS', 'Location', 'Price', 'Bedrooms', 'Bathrooms', 'Size', 'Price/SQ.Ft', 'Status']
```

Lets take a look at the first 2 rows of the dataframe.

```
In [17]: df.head(2)
```

Out[17]:

	MLS	Location	Price	Bedrooms	Bathrooms	Size	Price/SQ.Ft	Status
0	132842	Arroyo Grande	795000	3	3	2371	335.30	Short Sale
1	134364	Paso Robles	399000	4	3	2818	141.59	Short Sale

Next, lets look at a specific column or feature in the dataframe.

```
In [4]: print "Bedrooms:", df.Bedrooms.unique()
        print "Bathrooms:", df.Bathrooms.unique()

        Bedrooms: [ 3  4  2  7  1  5  0  6 10]
        Bathrooms: [ 3  4  1  2  5  7  6 11]
```

What if we want to drop a column from the dataframe?

```
In [119]: df = df.drop('Location', 1)
```

Let's rename the first column.

Hint: A Google search for 'python pandas dataframe rename' points you at this documentation (http://pandas-docs.github.io/pandas-docs-travis/ (http://pandas-docs.github.io/pandas-docs-travis/)).

```
In [18]: print df.columns
         df.rename(columns={df.columns[0]:'listing id'}, inplace=True)
         df.columns

         Index([u'MLS', u'Location', u'Price', u'Bedrooms', u'Bathrooms', u'Size',
                u'Price/SQ.Ft', u'Status'],
               dtype='object')

Out[18]: Index([u'listing id', u'Location', u'Price', u'Bedrooms', u'Bathrooms',
                u'Size', u'Price/SQ.Ft', u'Status'],
               dtype='object')
```

What is the max, min, mean/avg, and standard deviation of the column 'bedroomcnt'?

```
In [5]: print "Min: " , min(df['Price/SQ.Ft'])
        print "Max: " , max(df['Price/SQ.Ft'])
        print "Std: " , df['Price/SQ.Ft'].std()
        print "Avg: " , df['Price/SQ.Ft'].mean()
```

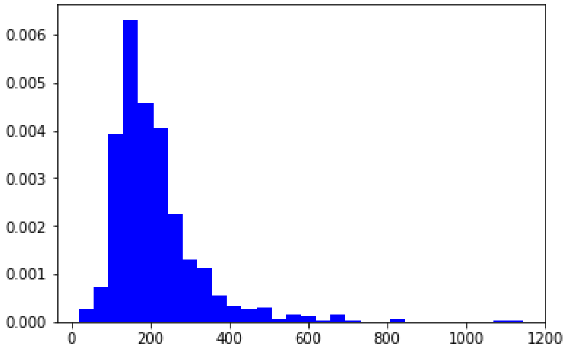
```
Min:  19.33
Max:  1144.64
Std:  115.082145976
Avg:  213.131293214
```

Plot the distribution of 'yearbuild' using matplotlib

```
In [13]: import matplotlib.mlab as mlab
         import matplotlib.pyplot as plt
         import numpy as np

         # remove NAN from array
         x = df['Price/SQ.Ft'][~np.isnan(df['Price/SQ.Ft'])]

         # plot histogram
         n, bins, patches = plt.hist(x, 30, normed=1, facecolor='blue')
         plt.show()
```



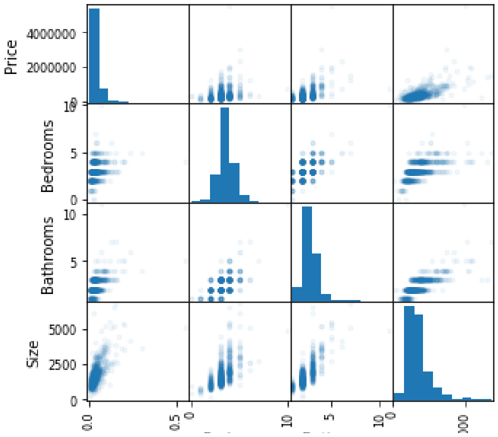
One of the best ways to inspect data is visualize it. One way to do this is by using a scatter plot. A scatter plot of the data puts one feature along the x-axis and another along the y-axis, and draws a dot for each data point.

Since its difficult to visualize more than 2 or 3 features, one possibility is to use a pair plot that looks at all possible pairs of features. The pair plot shows the interaction of each pair of features inorder to visualize any correlation between features.

```
In [15]: # import the scatter_matrix functionality
         import random as rand
         from pandas.tools.plotting import scatter_matrix
         import matplotlib.pyplot as plt

         print df.shape
         x = df.iloc[:,[1,2,3,4,5]] # extract only 5 columns from dataframe (using index)
         y = x.dropna(thresh=2) # drop any rows that have 2 or more fields as NAN
         a = pd.scatter_matrix(x, alpha=0.05, figsize=(5,5), diagonal='hist')
         plt.show()
```

```
(781, 8)
```



Let's create a crosstabulation or contingency table of the factors.

Hint: A Google search for 'python pandas cross tabulation' points you at this documentation (http://pandas.pydata.org/pandas-docs/stable/reshaping.html#cross-tabulations (http://pandas.pydata.org/pandas-docs/stable/reshaping.html#cross-tabulations)).

In [16]:

```
pd.crosstab(df.Bedrooms, df.Bathrooms)
```

Out[16]:

Bathrooms	1	2	3	4	5	6	7	11
Bedrooms								
0	2	0	0	0	0	0	0	0
1	10	1	0	0	0	0	0	0
2	33	78	12	0	0	0	0	0
3	20	286	119	5	1	0	0	0
4	0	76	76	19	6	0	0	0
5	0	3	16	9	0	2	1	0
6	0	0	3	0	0	0	1	0
7	0	0	0	0	1	0	0	0
10	0	0	0	0	0	0	0	1

In [37]:

```
fig=plt.figure()
plt.scatter(df.Price, df.Size)
axis = fig.gca() #get current axis
axis.set_title('Price vs Size')
axis.set_xlabel('Price')
axis.set_ylabel('Size')
fig.canvas.draw()
```

Pandas Data Munging

The first concept we deal with here is pandas groupby. The idea is to group a dataframe by the values of a particular factor variable. The documentation can be found here (http://pandas-docs.github.io/pandas-docs-travis/ (http://pandas-docs.github.io/pandas-docs-travis/)).

In [43]:

```
status_groupby = df.groupby('Status')
status_groupby.head()
```

Out[43]:

	listing id	Location	Price	Bedrooms	Bathrooms	Size	Price/SQ.Ft	Status
0	132842	Arroyo Grande	795000	3	3	2371	335.30	Short Sale
1	134364	Paso Robles	399000	4	3	2818	141.59	Short Sale
2	135141	Paso Robles	545000	4	3	3032	179.75	Short Sale
3	135712	Morro Bay	909000	4	4	3540	256.78	Short Sale
4	136282	Santa Maria-Orcutt	109900	3	1	1249	87.99	Short Sale
53	143436	Templeton	1399000	4	3	6500	215.23	Foreclosure
56	143534	Morro Bay	789000	3	3	2100	375.71	Foreclosure
63	144314	Morro Bay	899000	3	3	2430	369.96	Foreclosure
64	144316	Morro Bay	1045000	3	3	2100	497.62	Foreclosure
65	144318	Morro Bay	774000	2	2	1550	499.35	Foreclosure
617	154325	Lompoc	149900	3	1	1000	149.90	Regular
621	154329	Santa Maria-Orcutt	177000	3	2	1500	118.00	Regular
622	154330	Nipomo	122500	4	2	1248	98.16	Regular
626	154343	Arroyo Grande	425000	3	2	1437	295.76	Regular
628	154345	Nipomo	175000	2	2	1152	151.91	Regular

The function groupby gives you a dictionary-like object, with the keys being the values of the factor, and the values being the corresponding subsets of the dataframe.

In [47]:
```
# lets print the number of rows per each type of status
for key, value in status_groupby:
    print "( key, len(value) ) = (", key, ",", len(value), ")"
    v=value
```

```
( key, len(value) ) = ( Foreclosure , 162 )
( key, len(value) ) = ( Regular , 103 )
( key, len(value) ) = ( Short Sale , 516 )
```

The groupby function also acts like an object that can be mapped. After the mapping is complete, the rows are put together (reduced) into a larger dataframe. For example, using the describe function. The documentation of the describe function can be found here (http://pandas-docs.github.io/pandas-docs-travis/ (http://pandas-docs.github.io/pandas-docs-travis/)).

In [52]:
```
status_df =status_groupby['Bathrooms','Bedrooms','Price','Size','Price/SQ.Ft'].describe()
print type(status_df)
status_df.head(20)
```

```
<class 'pandas.core.frame.DataFrame'>
```

Out[52]:

		Bathrooms	Bedrooms	Price	Size	Price/SQ.Ft
Status						
Foreclosure	**count**	162.000000	162.000000	1.620000e+02	162.000000	162.000000
	mean	2.314815	3.216049	3.632146e+05	1762.493827	200.221605
	std	0.807359	0.956956	2.701240e+05	880.295908	97.433947
	min	1.000000	0.000000	2.900000e+04	628.000000	19.330000
	25%	2.000000	3.000000	1.811250e+05	1200.000000	140.050000
	50%	2.000000	3.000000	2.789500e+05	1500.000000	186.780000
	75%	3.000000	4.000000	4.437250e+05	2064.000000	225.525000
	max	7.000000	6.000000	1.799000e+06	6500.000000	686.020000
Regular	**count**	103.000000	103.000000	1.030000e+02	103.000000	103.000000
	mean	2.446602	3.048544	6.411621e+05	1926.699029	311.406796
	std	0.801080	0.832886	6.752140e+05	826.470618	189.019573
	min	1.000000	1.000000	2.650000e+04	120.000000	19.720000
	25%	2.000000	3.000000	3.154500e+05	1431.000000	200.100000
	50%	2.000000	3.000000	5.090000e+05	1832.000000	282.690000
	75%	3.000000	3.000000	7.620000e+05	2237.500000	369.740000
	max	6.000000	6.000000	5.499000e+06	5060.000000	1144.640000
Short Sale	**count**	516.000000	516.000000	5.160000e+02	516.000000	516.000000
	mean	2.350775	3.137597	3.381775e+05	1718.463178	197.567326
	std	0.867436	0.825834	2.365197e+05	795.330609	88.248737
	min	1.000000	0.000000	4.090000e+04	398.000000	34.050000

Another way of printing statistics using group by is shown below, without having to iterate through each item in the dataframe. You can find documentation about std function here (http://pandas-docs.github.io/pandas-docs-travis/ (http://pandas-docs.github.io/pandas-docs-travis/)).

In [57]:
```
status_df =df.groupby('Status').std()
print status_df
```

```
              listing id          Price  Bedrooms  Bathrooms        Size  \
Status
Foreclosure  2691.998699  270124.016966  0.956956   0.807359  880.295908
```