Data Preparation

December 6, 2021

0.0.1 Data Preparation

[1]:
```
import pandas as pd
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
```

Import Dataset

[2]:
```
import pandas as pd
df = pd.read_csv ('YelpDataset.csv', index_col = 0)
```

Dataset Description

[3]:
```
print(df)
```

```
                business_id  stars       city state  review_count  is_open  \
1     _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
2     _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
3     _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
4     _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
5     _3FBR7yCFDfeDeLsyWrPbQ      4  Vancouver    BC           211        1
…                        …    …         …   …             …       …
7417  ZZ7IXc-ZsyCPvdLPmHkPnw      4  Vancouver    BC            10        1
7418  ZZ7IXc-ZsyCPvdLPmHkPnw      4  Vancouver    BC            10        1
7419  ZZ7IXc-ZsyCPvdLPmHkPnw      4  Vancouver    BC            10        1
7420  ZzEcWEsSrT-klyErof4DMw      4  Vancouver    BC            32        1
7421  ZzEcWEsSrT-klyErof4DMw      4  Vancouver    BC            32        1

                                          categories              review_id  \
1     Chinese, Breakfast & Brunch, Restaurants, Cafes  vvbTNGUBjuwPy3-EJRKn3Q
2     Chinese, Breakfast & Brunch, Restaurants, Cafes  KIeZBzSyE01SdyDMvOamaQ
3     Chinese, Breakfast & Brunch, Restaurants, Cafes  jQjJNKnGLqsnNXTiYsBVbQ
4     Chinese, Breakfast & Brunch, Restaurants, Cafes  5RR5VRgFkWEIIJ7V-CDucw
5          Bars, Restaurants, Asian Fusion, Nightlife  r6cHt6WNakttlTsH-Xke2w
…                                                  …                       …
```

```
7417        Food, Mediterranean, Donairs, Restaurants  mq5OV7Xi3MI21htGtuaNLw
7418        Food, Mediterranean, Donairs, Restaurants  ZYrJENX3Pvcw8zyKp5L4Qg
7419        Food, Mediterranean, Donairs, Restaurants  vIShSMtQosNEkzGMUB5PUQ
7420            Sandwiches, Pizza, Salad, Restaurants  wkuyZhd8JFxY2d6aIHBTuA
7421            Sandwiches, Pizza, Salad, Restaurants  xnHGLNnzT4SeaYBa33I0yg

                     date                                                text
1     2018-01-19 16:02:36  ok service\nfood was ok nothing special\nover …
2     2018-03-25 07:37:32  Overpriced for what you get but great baked po…
3     2018-05-17 21:16:35  I agree with everyone that the price is on the…
4     2018-01-07 07:58:12  Great little Hong Kong styled cafe. The food i…
5     2018-09-23 15:48:42  This is a nice place in Chinatown Vancouver. I…
…                     …                                                 …
7417  2018-03-30 03:14:30  I had chicken donair (after tax about $7) and …
7418  2018-09-04 20:47:01  Newer donair shop. Decided to try since it loo…
7419  2018-03-02 05:00:34  After a dismal experience down the street at B…
7420  2018-10-28 06:58:47  Omo. How come I've never been here till now? I…
7421  2018-09-26 03:27:06  Very cheesy and the owner was super friendly :…

[7421 rows x 10 columns]
```

[4]:
```
df.head(5)
```

[4]:
```
              business_id  stars       city state  review_count  is_open  \
1  _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
2  _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
3  _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
4  _-4KBW-tUcqeyg3MAMWKVg      3   Richmond    BC            67        1
5  _3FBR7yCFDfeDeLsyWrPbQ      4  Vancouver    BC           211        1

                                      categories               review_id  \
1  Chinese, Breakfast & Brunch, Restaurants, Cafes  vvbTNGUBjuwPy3-EJRKn3Q
2  Chinese, Breakfast & Brunch, Restaurants, Cafes  KIeZBzSyE01SdyDMvOamaQ
3  Chinese, Breakfast & Brunch, Restaurants, Cafes  jQjJNKnGLqsnNXTiYsBVbQ
4  Chinese, Breakfast & Brunch, Restaurants, Cafes  5RR5VRgFkWEIIJ7V-CDucw
5       Bars, Restaurants, Asian Fusion, Nightlife  r6cHt6WNakttlTsH-Xke2w

                  date                                                text
1  2018-01-19 16:02:36  ok service\nfood was ok nothing special\nover …
2  2018-03-25 07:37:32  Overpriced for what you get but great baked po…
3  2018-05-17 21:16:35  I agree with everyone that the price is on the…
4  2018-01-07 07:58:12  Great little Hong Kong styled cafe. The food i…
5  2018-09-23 15:48:42  This is a nice place in Chinatown Vancouver. I…
```

Dataset Types

[5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7421 entries, 1 to 7421
Data columns (total 10 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   business_id   7421 non-null   object
 1   stars         7421 non-null   int64 
 2   city          7421 non-null   object
 3   state         7421 non-null   object
 4   review_count  7421 non-null   int64 
 5   is_open       7421 non-null   int64 
 6   categories    7421 non-null   object
 7   review_id     7421 non-null   object
 8   date          7421 non-null   object
 9   text          7421 non-null   object
dtypes: int64(3), object(7)
memory usage: 637.7+ KB
```

Statistical Analysis of the Dataset

[6]:
```
df.describe()
```

[6]:

	stars	review_count	is_open
count	7421.000000	7421.000000	7421.0
mean	3.852176	256.773885	1.0
std	0.492920	342.076862	0.0
min	1.000000	5.000000	1.0
25%	4.000000	66.000000	1.0
50%	4.000000	137.000000	1.0
75%	4.000000	303.000000	1.0
max	5.000000	2302.000000	1.0

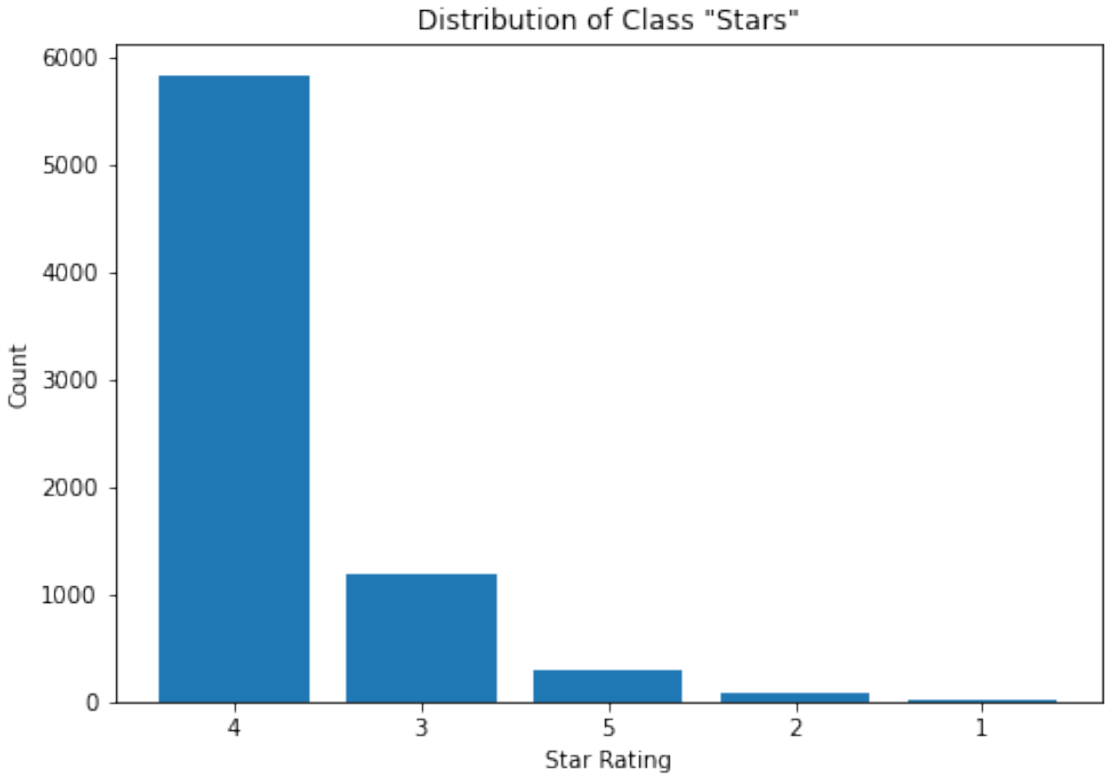
Count Value of Stars Attribute

[7]:
```
df['stars'].value_counts()
```

[7]:
```
4    5835
3    1186
5     302
2      81
1      17
Name: stars, dtype: int64
```

[8]:
```
fig = plt.figure()
ax = fig.add_axes([0, 0, 1, 1])
labels = ["4", "3", "5", "2", "1"]
x = df['stars'].value_counts()
```

```
ax.bar(labels, x)
ax.set_ylabel('Count')
ax.set_xlabel('Star Rating')
ax.set_title('Distribution of Class "Stars"')
plt.savefig('output2.png', dpi = 250, bbox_inches = 'tight')
plt.show()
```



Identify Missing Values in Dataset

[9]:
```
df.isna().sum()
```

[9]:
```
business_id     0
stars           0
city            0
state           0
review_count    0
is_open         0
categories      0
review_id       0
date            0
text            0
dtype: int64
```

No action needed, this dataset does not have missing values.

Extracting Month From Date Attribute

[10]:
```
month = []

for i in range(0, len(df)):
    month.append(int(df.iloc[i].date[5:7]))

df['month'] = month

df['month'].value_counts()
```

[10]:
```
7     754
8     740
1     658
4     639
9     622
6     610
5     607
3     599
10    586
11    550
12    545
2     511
Name: month, dtype: int64
```

Data Type Transformation

[11]:
```
def convert(data):
    encode = LabelEncoder()
    data['business_id'] = encode.fit_transform(data.business_id)
    data['city'] = encode.fit_transform(data.city)
    data['state'] = encode.fit_transform(data.state)
    data['categories'] = encode.fit_transform(data.categories)
    data['review_id'] = encode.fit_transform(data.review_id)
    data['date'] = encode.fit_transform(data.date)
    data['text'] = encode.fit_transform(data.text)
    data=data.fillna(-999)
    return data

df = convert(df)
df = convert(df)
```

Dataset with Modified Values

[12]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7421 entries, 1 to 7421
Data columns (total 11 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   business_id   7421 non-null   int64
 1   stars         7421 non-null   int64
 2   city          7421 non-null   int64
 3   state         7421 non-null   int64
 4   review_count  7421 non-null   int64
 5   is_open       7421 non-null   int64
 6   categories    7421 non-null   int64
 7   review_id     7421 non-null   int64
 8   date          7421 non-null   int64
 9   text          7421 non-null   int64
 10  month         7421 non-null   int64
dtypes: int64(11)
memory usage: 695.7 KB
```

[13]:
```
df.describe()
```

[13]:

	business_id	stars	city	state	review_count	is_open	\
count	7421.000000	7421.000000	7421.000000	7421.0	7421.000000	7421.0	
mean	730.908907	3.852176	12.640210	0.0	256.773885	1.0	
std	422.489017	0.492920	4.503837	0.0	342.076862	0.0	
min	0.000000	1.000000	0.000000	0.0	5.000000	1.0	
25%	376.000000	4.000000	12.000000	0.0	66.000000	1.0	
50%	714.000000	4.000000	15.000000	0.0	137.000000	1.0	
75%	1095.000000	4.000000	15.000000	0.0	303.000000	1.0	
max	1435.000000	5.000000	16.000000	0.0	2302.000000	1.0	

	categories	review_id	date	text	month
count	7421.000000	7421.000000	7421.000000	7421.000000	7421.000000
mean	573.972645	3710.000000	3709.625657	3706.189328	6.464627
std	329.773836	2142.402507	2141.996831	2139.824393	3.357334
min	0.000000	0.000000	0.000000	0.000000	1.000000
25%	286.000000	1855.000000	1855.000000	1854.000000	4.000000
50%	551.000000	3710.000000	3710.000000	3706.000000	7.000000
75%	871.000000	5565.000000	5564.000000	5558.000000	9.000000
max	1100.000000	7420.000000	7419.000000	7413.000000	12.000000

Correlation Analysis

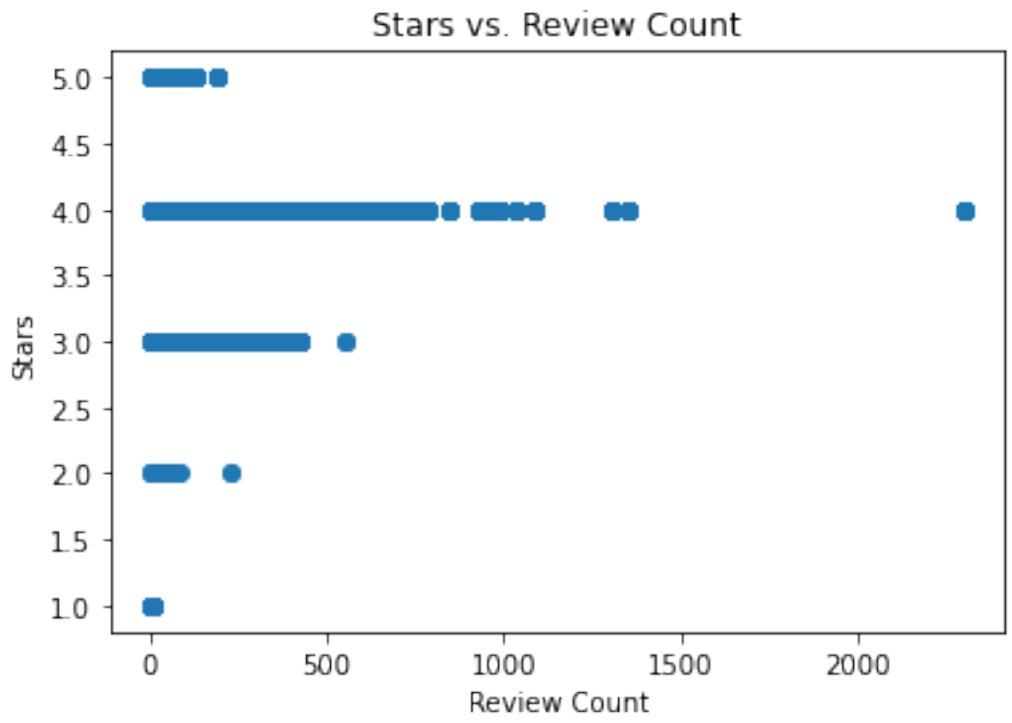
[14]:
```
correlation = df.corr()
print(correlation)
```

```
             business_id     stars      city  state  review_count  is_open  \
business_id     1.000000  0.007146  0.057074    NaN      0.038179      NaN
```

```
stars            0.007146  1.000000  0.123921    NaN      0.139180      NaN
city             0.057074  0.123921  1.000000    NaN      0.243711      NaN
state                 NaN       NaN       NaN    NaN           NaN      NaN
review_count     0.038179  0.139180  0.243711    NaN      1.000000      NaN
is_open               NaN       NaN       NaN    NaN           NaN      NaN
categories       0.019585 -0.027075 -0.010481    NaN     -0.120060      NaN
review_id        0.007440 -0.002251 -0.006815    NaN     -0.000257      NaN
date             0.008044  0.011495  0.004474    NaN     -0.000294      NaN
text             0.016763 -0.042705 -0.010314    NaN     -0.002612      NaN
month            0.007292  0.012761  0.003133    NaN      0.001831      NaN

              categories  review_id      date      text     month
business_id     0.019585   0.007440  0.008044  0.016763  0.007292
stars          -0.027075  -0.002251  0.011495 -0.042705  0.012761
city           -0.010481  -0.006815  0.004474 -0.010314  0.003133
state                NaN        NaN       NaN       NaN       NaN
review_count   -0.120060  -0.000257 -0.000294 -0.002612  0.001831
is_open              NaN        NaN       NaN       NaN       NaN
categories      1.000000   0.014122 -0.030623  0.003670 -0.029189
review_id       0.014122   1.000000 -0.012251  0.002587 -0.013396
date           -0.030623  -0.012251  1.000000 -0.032351  0.995850
text            0.003670   0.002587 -0.032351  1.000000 -0.033691
month          -0.029189  -0.013396  0.995850 -0.033691  1.000000
```

[15]:
```
plt.scatter( x = 'review_count', y = 'stars', data = df)
plt.title("Stars vs. Review Count")
plt.xlabel("Review Count")
plt.ylabel("Stars")
plt.savefig('output3.png', dpi = 250, bbox_inches = 'tight')
```



Correlation of attributes review count with stars

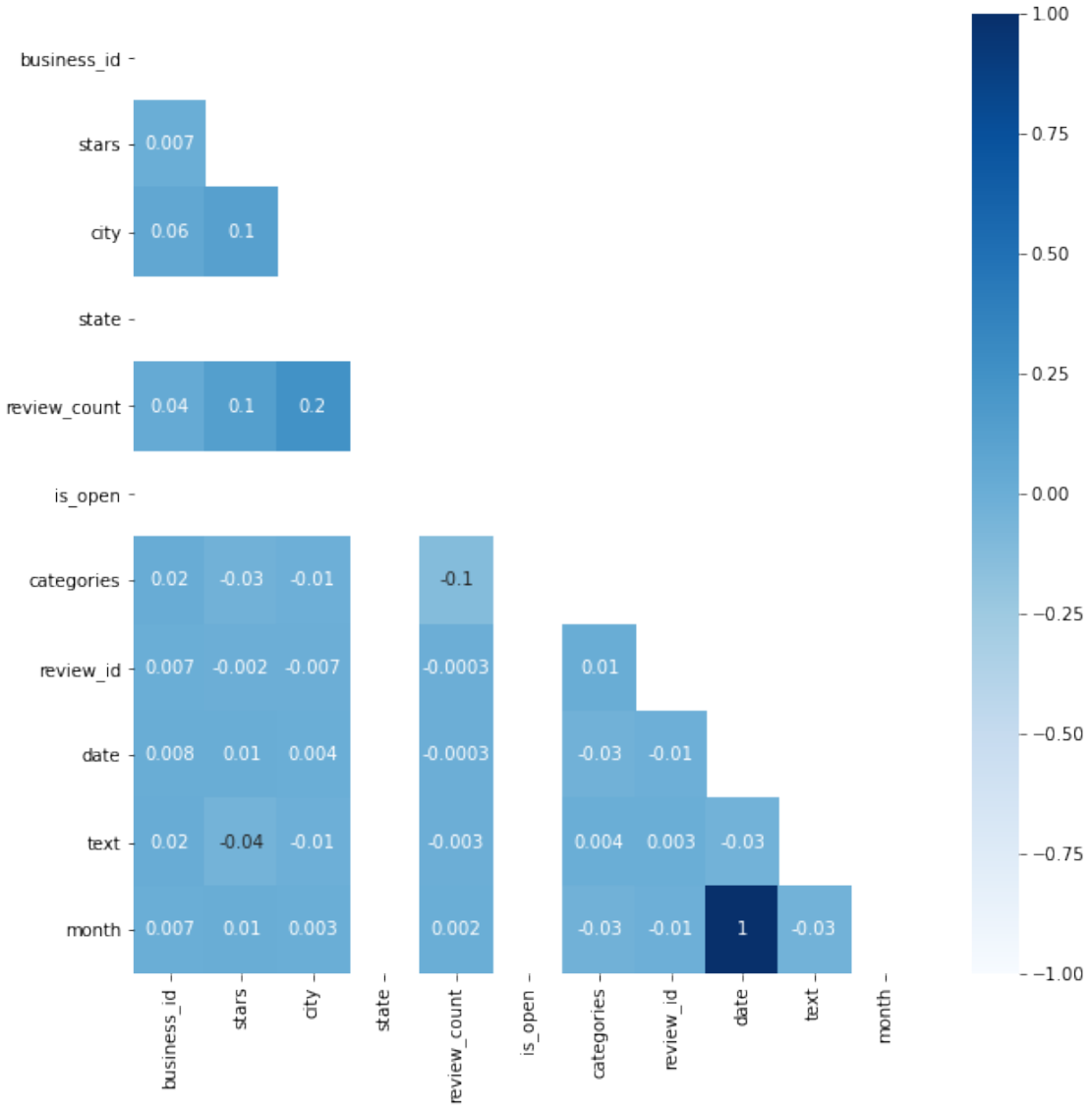
Coefficient of Correlation

[16]:
```
from scipy import stats
stats.pearsonr(df['stars'], df['review_count'])
```

[16]:
```
(0.13918006520614612, 2.0273007378850047e-33)
```

Correlation Matrix

[17]:
```
matrix = np.triu(correlation)
fig, ax = plt.subplots(figsize = (10,10))
sns.heatmap(df.corr(), annot = True, ax = ax, fmt = '.1g', vmin = -1, vmax = 1,␣
 ↪center = 0, mask = matrix, cmap = 'Blues')
plt.savefig('output4.png', dpi = 250, bbox_inches = 'tight')
plt.show()
```



[18]:
```
cormat = df.corr()
round(cormat, 2)
```

[18]:

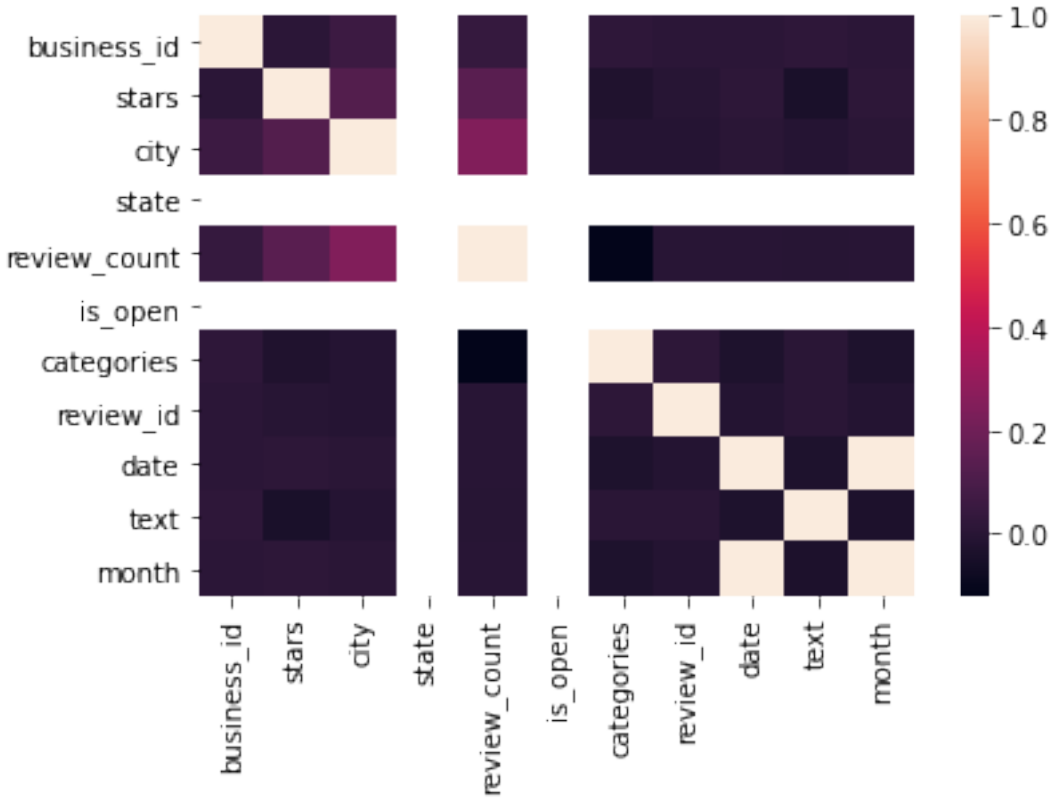
	business_id	stars	city	state	review_count	is_open	\
business_id	1.00	0.01	0.06	NaN	0.04	NaN	
stars	0.01	1.00	0.12	NaN	0.14	NaN	
city	0.06	0.12	1.00	NaN	0.24	NaN	
state	NaN	NaN	NaN	NaN	NaN	NaN	
review_count	0.04	0.14	0.24	NaN	1.00	NaN	
is_open	NaN	NaN	NaN	NaN	NaN	NaN	
categories	0.02	-0.03	-0.01	NaN	-0.12	NaN	
review_id	0.01	-0.00	-0.01	NaN	-0.00	NaN	

```
date                 0.01   0.01  0.00    NaN          -0.00      NaN
text                 0.02  -0.04 -0.01    NaN          -0.00      NaN
month                0.01   0.01  0.00    NaN           0.00      NaN

             categories  review_id  date  text  month
business_id        0.02       0.01  0.01  0.02   0.01
stars             -0.03      -0.00  0.01 -0.04   0.01
city              -0.01      -0.01  0.00 -0.01   0.00
state               NaN        NaN   NaN   NaN    NaN
review_count      -0.12      -0.00 -0.00 -0.00   0.00
is_open             NaN        NaN   NaN   NaN    NaN
categories         1.00       0.01 -0.03  0.00  -0.03
review_id          0.01       1.00 -0.01  0.00  -0.01
date              -0.03      -0.01  1.00 -0.03   1.00
text               0.00       0.00 -0.03  1.00  -0.03
month             -0.03      -0.01  1.00 -0.03   1.00
```

Correlation Matrix to Heat Map

[19]:
```
sns.heatmap(cormat)
plt.savefig('output5.png', dpi = 250, bbox_inches = 'tight')
```

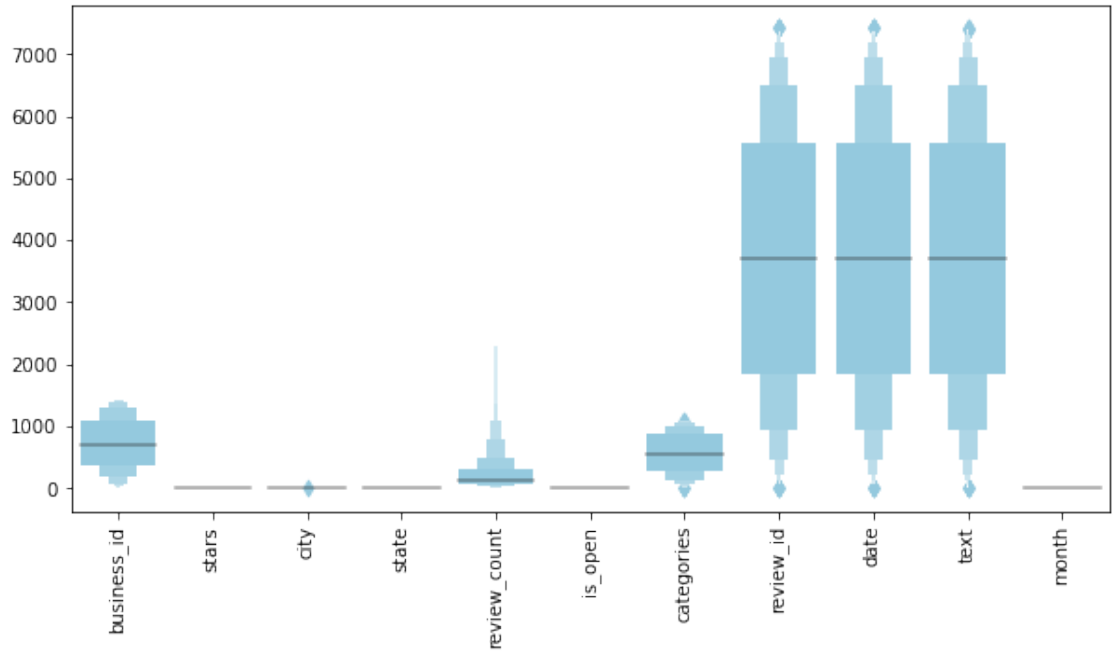


From the above correlation analysis we can conclude the following:

- There are no attributes that have a high liner correlation
- The following attributes have a low linear correlation:
  - Stars and review count and stars and city have a correlation of 0.2
  - City and review_count have a correlation of 0.3

Boxplot of Attributes

[20]:
```
plt.figure(figsize = (10, 5))
sns.boxenplot(data = df,color = "skyblue")
plt.xticks(rotation = 90)
plt.savefig('output6.png', dpi = 250, bbox_inches = 'tight')
plt.show()
```

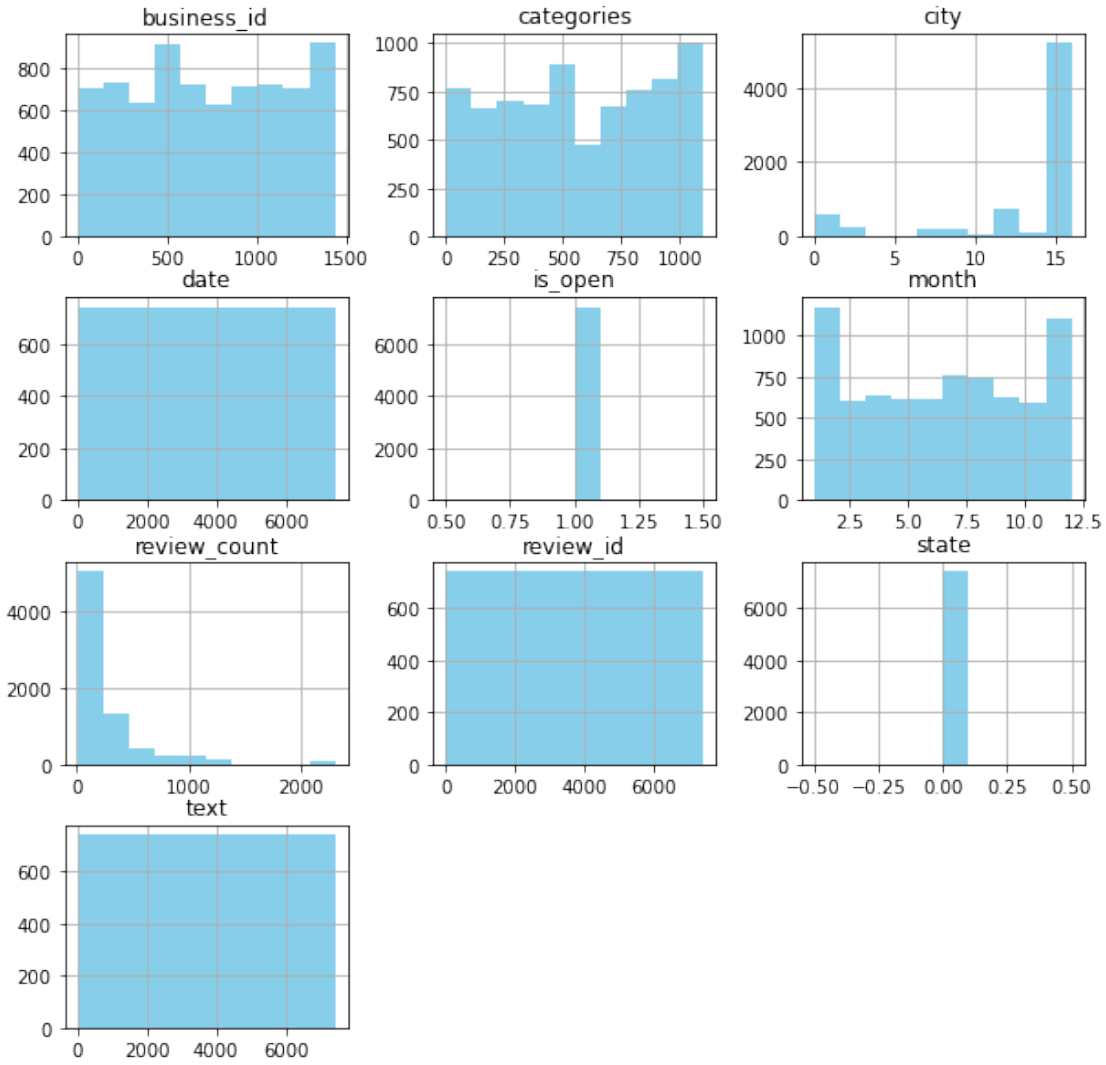


Histogram of Attributes

[21]:
```
dfx = df.drop(columns = ['stars'])
fig, ax = plt.subplots(1, 1, figsize = (10, 10))
dfx.hist(ax = ax, color = 'skyblue')
plt.savefig('output7.png', dpi = 250, bbox_inches = 'tight')
plt.show()
```

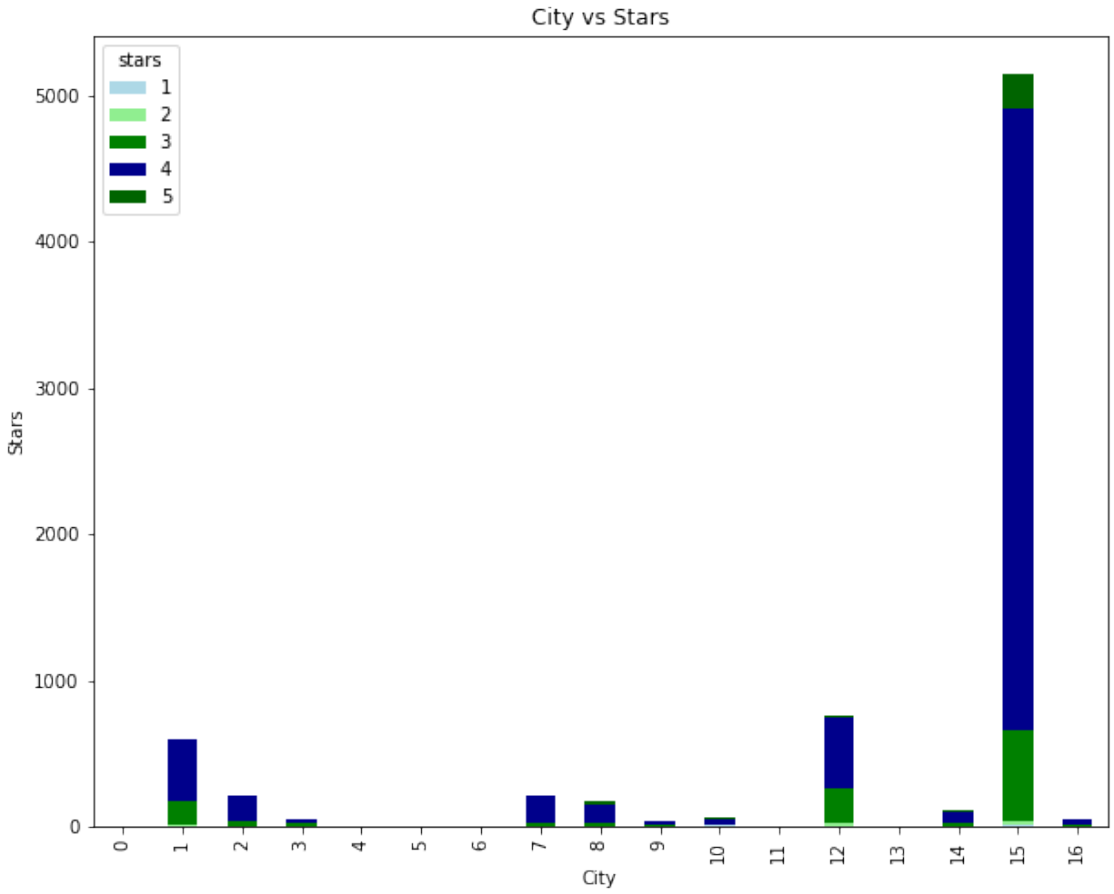
```
/opt/conda/lib/python3.7/site-packages/ipykernel_launcher.py:3: UserWarning: To
output multiple subplots, the figure containing the passed axes is being cleared
```

```
  This is separate from the ipykernel package so we can avoid doing imports
until
```



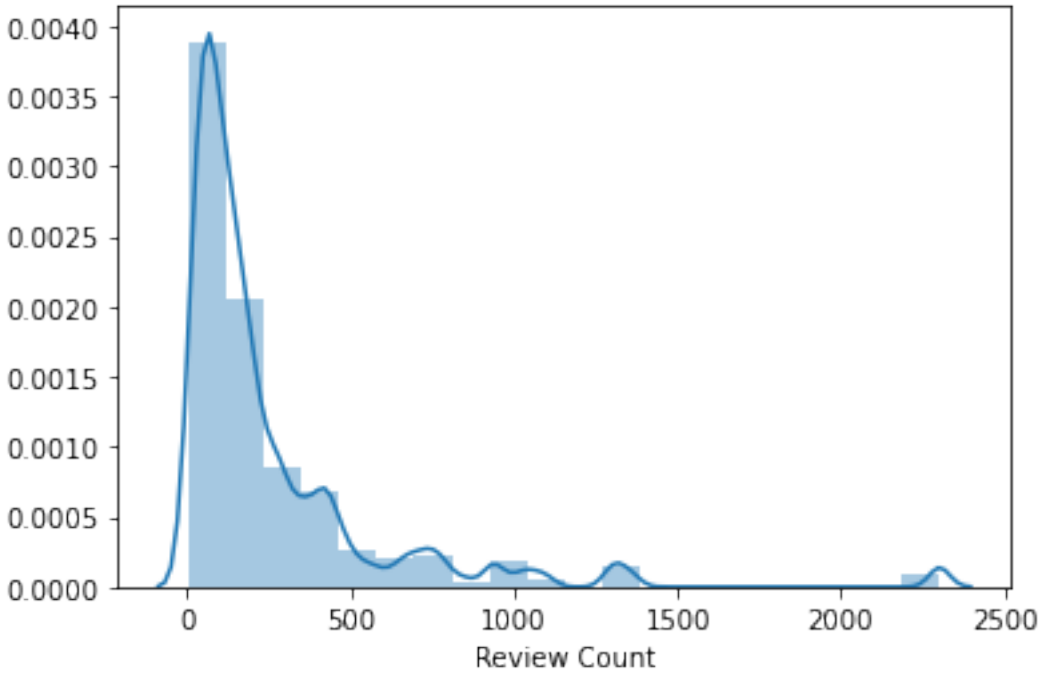
Distribution of Star Ratings for Each City

[22]:
```
plot1 = pd.crosstab(df['city'], df['stars'])
plot1.plot(kind = 'bar', stacked = True, figsize = (10, 8), color =␣
 ↪['lightblue', 'lightgreen', 'green', 'darkblue', 'darkgreen'])
plt.title('City vs Stars')
plt.xlabel("City")
plt.ylabel("Stars")
plt.savefig('output8.png', dpi = 250, bbox_inches = 'tight')
plt.show()
```



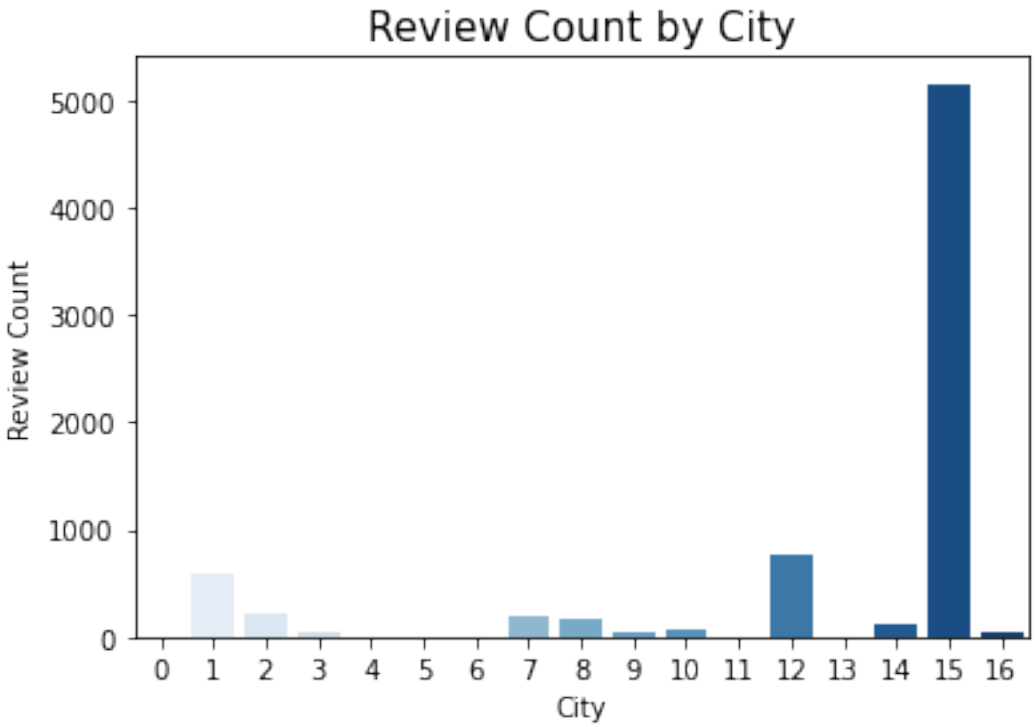
Distribution for Review Count Attribute

[23]:
```
p = sns.distplot(df['review_count'], bins = 20)
p.set_xlabel("Review Count")
plt.savefig('output9.png', dpi = 250, bbox_inches = 'tight')
```



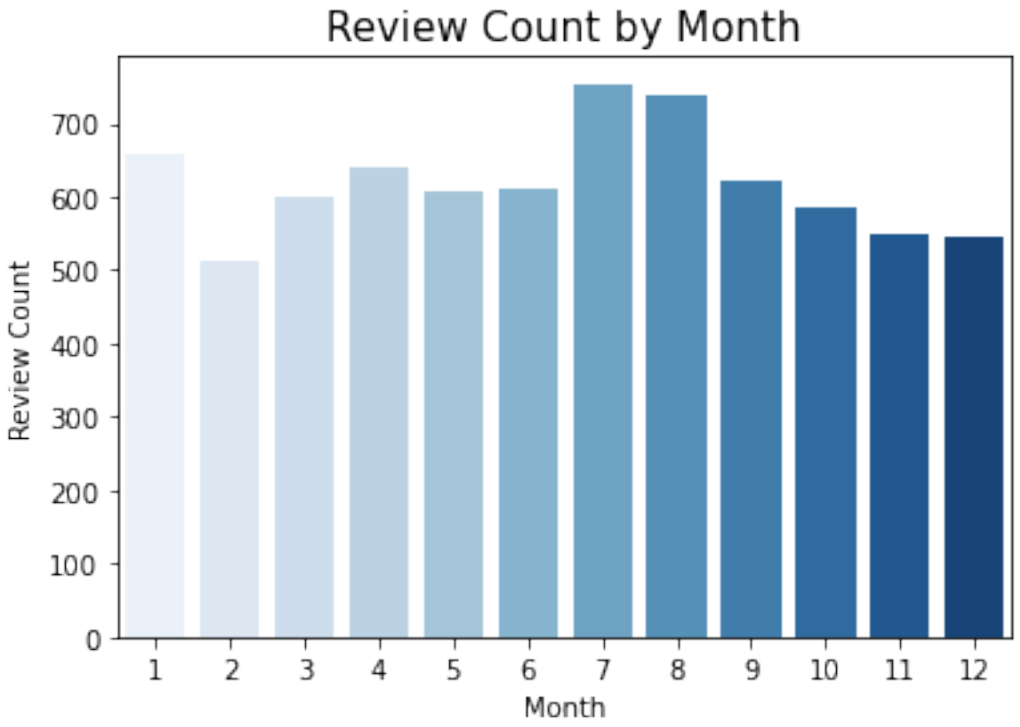
Checking the Distribution of Review Count by City

[24]:
```
plt.subplot(1, 1, 1)
sns.countplot(df['city'], palette = 'Blues')
plt.title('Review Count by City', fontsize = 15)
plt.xlabel('City', fontsize = 10)
plt.ylabel('Review Count', fontsize = 10)
plt.savefig('output10.png', dpi = 250, bbox_inches = 'tight')
```



Checking the Distribution of Review Count by Month

[25]:
```
plt.subplot(1, 1, 1)
sns.countplot(df['month'], palette = 'Blues')
plt.title('Review Count by Month', fontsize = 15)
plt.xlabel('Month', fontsize = 10)
plt.ylabel('Review Count', fontsize = 10)
plt.savefig('output11.png', dpi = 250, bbox_inches = 'tight')
```


Review Count by Month
Review Count
0
100
200
300
400
500
600
700
1
2
3
4
5
6
7
8
9
10
11
12
Month

[ ]: