Analysis of Yelp Business Intelligence Data

In [1]:

```
%%info
```

Current session configs: `{'conf': {'spark.pyspark.python': 'python3', 'spark.pyspark.virtualenv.enabled': 'true', 'spark.pyspark.virtualenv.type': 'native', 'spark.pyspark.virtualenv.bin.path': '/usr/bin/virtualenv'}, 'kind': 'pyspark'}`

No active sessions.

Installation and Initial Setup

In [2]:

```
sc.list_packages()
```

```
Starting Spark application
```

ID	YARN Application ID	Kind	State	Spark UI	Driver log	Current session?
1	application_1618973538330_0002	pyspark	idle			✓

```
SparkSession available as 'spark'.

Package                    Version
-------------------------- ---------
beautifulsoup4             4.9.1
boto                       2.49.0
click                      7.1.2
jmespath                   0.10.0
joblib                     0.16.0
lxml                       4.5.2
mysqlclient                1.4.2
nltk                       3.5
nose                       1.3.4
numpy                      1.16.5
pip                        9.0.1
py-dateutil                2.2
python37-sagemaker-pyspark 1.4.0
pytz                       2020.1
PyYAML                     5.3.1
regex                      2020.7.14
setuptools                 28.8.0
six                        1.13.0
soupsieve                  1.9.5
tqdm                       4.48.2
wheel                      0.29.0
windmill                   1.6
```

In [28]:

```
sc.install_pypi_package("pandas==1.0.3")
sc.install_pypi_package("matplotlib==3.2.1")
sc.install_pypi_package("seaborn")
```

```
Collecting pandas==1.0.3
  Downloading https://files.pythonhosted.org/packages/4a/6a/94b219b8ea0f2d5801
69e85ed1edc0163743f55aaeca8a44c2e8fc1e344e/pandas-1.0.3-cp37-cp37m-manylinux1_
x86_64.whl (10.0MB)
```

```
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/site-p
ackages (from pandas==1.0.3)
Requirement already satisfied: numpy>=1.13.3 in /usr/local/lib64/python3.7/sit
e-packages (from pandas==1.0.3)
Collecting python-dateutil>=2.6.1 (from pandas==1.0.3)
  Downloading https://files.pythonhosted.org/packages/d4/70/d60450c3dd48ef8758
6924207ae8907090de0b306af2bce5d134d78615cb/python_dateutil-2.8.1-py2.py3-none-
any.whl (227kB)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/site-packa
ges (from python-dateutil>=2.6.1->pandas==1.0.3)
Installing collected packages: python-dateutil, pandas
Successfully installed pandas-1.0.3 python-dateutil-2.8.1

Collecting matplotlib==3.2.1
  Downloading https://files.pythonhosted.org/packages/b2/c2/71fcf957710f3ba1f0
9088b35776a799ba7dd95f7c2b195ec800933b276b/matplotlib-3.2.1-cp37-cp37m-manylin
ux1_x86_64.whl (12.4MB)
Requirement already satisfied: python-dateutil>=2.1 in /mnt/tmp/1619563336363-
0/lib/python3.7/site-packages (from matplotlib==3.2.1)
Collecting pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 (from matplotlib==3.2.1)
  Downloading https://files.pythonhosted.org/packages/8a/bb/488841f56197b13700
afd5658fc279a2025a39e22449b7cf29864669b15d/pyparsing-2.4.7-py2.py3-none-any.wh
l (67kB)
Collecting cycler>=0.10 (from matplotlib==3.2.1)
  Downloading https://files.pythonhosted.org/packages/f7/d2/e07d3ebb2bd7af6964
40ce7e754c59dd546ffe1bbe732c8ab68b9c834e61/cycler-0.10.0-py2.py3-none-any.whl
Requirement already satisfied: numpy>=1.11 in /usr/local/lib64/python3.7/site-
packages (from matplotlib==3.2.1)
Collecting kiwisolver>=1.0.1 (from matplotlib==3.2.1)
  Downloading https://files.pythonhosted.org/packages/d2/46/231de802ade4225b76
b96cffe419cf3ce52bbe92e3b092cf12db7d11c207/kiwisolver-1.3.1-cp37-cp37m-manylin
ux1_x86_64.whl (1.1MB)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/site-packa
ges (from python-dateutil>=2.1->matplotlib==3.2.1)
Installing collected packages: pyparsing, cycler, kiwisolver, matplotlib
Successfully installed cycler-0.10.0 kiwisolver-1.3.1 matplotlib-3.2.1 pyparsi
ng-2.4.7

Collecting seaborn
  Downloading https://files.pythonhosted.org/packages/68/ad/6c2406ae175f59ec61
6714e408979b674fe27b9587f79d59a528ddfbcd5b/seaborn-0.11.1-py3-none-any.whl (28
5kB)
Requirement already satisfied: numpy>=1.15 in /usr/local/lib64/python3.7/site-
packages (from seaborn)
Collecting scipy>=1.0 (from seaborn)
  Downloading https://files.pythonhosted.org/packages/7d/e8/43ffca541d2f208d51
6296950b25fe1084b35c2881f4d444c1346ca75815/scipy-1.6.3-cp37-cp37m-manylinux1_x
86_64.whl (27.4MB)
Requirement already satisfied: matplotlib>=2.2 in /mnt/tmp/1619563336363-0/li
b/python3.7/site-packages (from seaborn)
Requirement already satisfied: pandas>=0.23 in /mnt/tmp/1619563336363-0/lib/py
thon3.7/site-packages (from seaborn)
Requirement already satisfied: python-dateutil>=2.1 in /mnt/tmp/1619563336363-
0/lib/python3.7/site-packages (from matplotlib>=2.2->seaborn)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /mn
t/tmp/1619563336363-0/lib/python3.7/site-packages (from matplotlib>=2.2->seabo
rn)
Requirement already satisfied: cycler>=0.10 in /mnt/tmp/1619563336363-0/lib/py
thon3.7/site-packages (from matplotlib>=2.2->seaborn)
Requirement already satisfied: kiwisolver>=1.0.1 in /mnt/tmp/1619563336363-0/l
ib/python3.7/site-packages (from matplotlib>=2.2->seaborn)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/site-p
ackages (from pandas>=0.23->seaborn)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/site-packa
ges (from python-dateutil>=2.1->matplotlib>=2.2->seaborn)
Installing collected packages: scipy, seaborn
Successfully installed scipy-1.6.3 seaborn-0.11.1
```

Importing

In [32]:

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

Loading Data

In [2]:

```
df = spark.read.json('s3://sta9760-spark-s3-dataset/yelp/yelp_academic_datase
```

Overview of Data

In [13]:

```
print('Columns:',len(df.columns),'|','Rows:',df.count())
```

```
Columns: 14 | Rows: 160585
```

In [14]:

```
df.printSchema()
```

```
root
 |-- address: string (nullable = true)
 |-- attributes: struct (nullable = true)
 |    |-- AcceptsInsurance: string (nullable = true)
 |    |-- AgesAllowed: string (nullable = true)
 |    |-- Alcohol: string (nullable = true)
 |    |-- Ambience: string (nullable = true)
 |    |-- BYOB: string (nullable = true)
 |    |-- BYOBCorkage: string (nullable = true)
 |    |-- BestNights: string (nullable = true)
 |    |-- BikeParking: string (nullable = true)
 |    |-- BusinessAcceptsBitcoin: string (nullable = true)
 |    |-- BusinessAcceptsCreditCards: string (nullable = true)
 |    |-- BusinessParking: string (nullable = true)
 |    |-- ByAppointmentOnly: string (nullable = true)
 |    |-- Caters: string (nullable = true)
 |    |-- CoatCheck: string (nullable = true)
 |    |-- Corkage: string (nullable = true)
 |    |-- DietaryRestrictions: string (nullable = true)
 |    |-- DogsAllowed: string (nullable = true)
 |    |-- DriveThru: string (nullable = true)
 |    |-- GoodForDancing: string (nullable = true)
 |    |-- GoodForKids: string (nullable = true)
 |    |-- GoodForMeal: string (nullable = true)
 |    |-- HairSpecializesIn: string (nullable = true)
 |    |-- HappyHour: string (nullable = true)
 |    |-- HasTV: string (nullable = true)
 |    |-- Music: string (nullable = true)
 |    |-- NoiseLevel: string (nullable = true)
 |    |-- Open24Hours: string (nullable = true)
 |    |-- OutdoorSeating: string (nullable = true)
 |    |-- RestaurantsAttire: string (nullable = true)
 |    |-- RestaurantsCounterService: string (nullable = true)
 |    |-- RestaurantsDelivery: string (nullable = true)
 |    |-- RestaurantsGoodForGroups: string (nullable = true)
 |    |-- RestaurantsPriceRange2: string (nullable = true)
 |    |-- RestaurantsReservations: string (nullable = true)
 |    |-- RestaurantsTableService: string (nullable = true)
 |    |-- RestaurantsTakeOut: string (nullable = true)
 |    |-- Smoking: string (nullable = true)
 |    |-- WheelchairAccessible: string (nullable = true)
 |    |-- WiFi: string (nullable = true)
 |-- business_id: string (nullable = true)
 |-- categories: string (nullable = true)
 |-- city: string (nullable = true)
 |-- hours: struct (nullable = true)
 |    |-- Friday: string (nullable = true)
 |    |-- Monday: string (nullable = true)
 |    |-- Saturday: string (nullable = true)
 |    |-- Sunday: string (nullable = true)
 |    |-- Thursday: string (nullable = true)
 |    |-- Tuesday: string (nullable = true)
 |    |-- Wednesday: string (nullable = true)
 |-- is_open: long (nullable = true)
 |-- latitude: double (nullable = true)
 |-- longitude: double (nullable = true)
 |-- name: string (nullable = true)
 |-- postal_code: string (nullable = true)
 |-- review_count: long (nullable = true)
 |-- stars: double (nullable = true)
 |-- state: string (nullable = true)
```

In [15]:

```
df.select('business_id','name','city','state','stars','categories').show(5)
```

```
+--------------------+--------------------+-----------+-----+-----+-----------
---------+
|         business_id|                name|       city|state|stars|          c
ategories|
+--------------------+--------------------+-----------+-----+-----+-----------
---------+
|6iYb2HFDywm3zjuRg...| Oskar Blues Taproom|    Boulder|   CO|  4.0|Gastropubs,
Food,...|
|tCbdrRPZA0oiIYSmH...|Flying Elephants ...|   Portland|   OR|  4.0|Salad, Sou
p, Sand...|
|bvN78flM8NLprQ1a1...|      The Reclaimory|   Portland|   OR|  4.5|Antiques, F
ashion...|
|oaepsyvc0J17qwi8c...|         Great Clips|Orange City|   FL|  3.0|Beauty & Sp
as, Ha...|
|PE9uqAjdw0E4-8mjG...|   Crossfit Terminus|    Atlanta|   GA|  4.0|Gyms, Activ
e Life...|
+--------------------+--------------------+-----------+-----+-----+-----------
---------+
only showing top 5 rows
```

Analyzing Categories

Association Table

In [9]:

```
from pyspark.sql.functions import split, explode
df_new=df.withColumn('categories',explode(split('categories',',')))
```

In [10]:

```
df_new.select('business_id','categories').show(5)
```

```
+--------------------+-------------+
|         business_id|   categories|
+--------------------+-------------+
|6iYb2HFDywm3zjuRg...|   Gastropubs|
|6iYb2HFDywm3zjuRg...|         Food|
|6iYb2HFDywm3zjuRg...| Beer Gardens|
|6iYb2HFDywm3zjuRg...|  Restaurants|
|6iYb2HFDywm3zjuRg...|         Bars|
+--------------------+-------------+
only showing top 5 rows
```

Total Unique Categories

In [12]:

```
import pyspark.sql.functions as F
df_new.select(F.countDistinct("categories")).show()
```

```
+--------------------------+
|count(DISTINCT categories)|
+--------------------------+
|                      2487|
+--------------------------+
```

Top Categories By Business

Counts of Businesses / Category

In [13]:

```
barchart_df = df_new.groupBy("categories").agg(F.countDistinct("business_id")
barchart_df.show()
```

```
+--------------------+--------------+
|          categories|distinct_count|
+--------------------+--------------+
|         Restaurants|         36340|
|                Food|         22094|
|            Shopping|         20056|
|         Restaurants|         14423|
|       Home Services|         12001|
|       Beauty & Spas|         11633|
|    Health & Medical|         11390|
|           Nightlife|          9808|
|      Local Services|          9299|
|                Bars|          8914|
| Event Planning &...|          7617|
|                Food|          7375|
|         Active Life|          7039|
|          Automotive|          6785|
|            Shopping|          6149|
|        Coffee & Tea|          5735|
|          Sandwiches|          5697|
| American (Tradit...|          5235|
|             Fashion|          5231|
|       Beauty & Spas|          4941|
+--------------------+--------------+
only showing top 20 rows
```

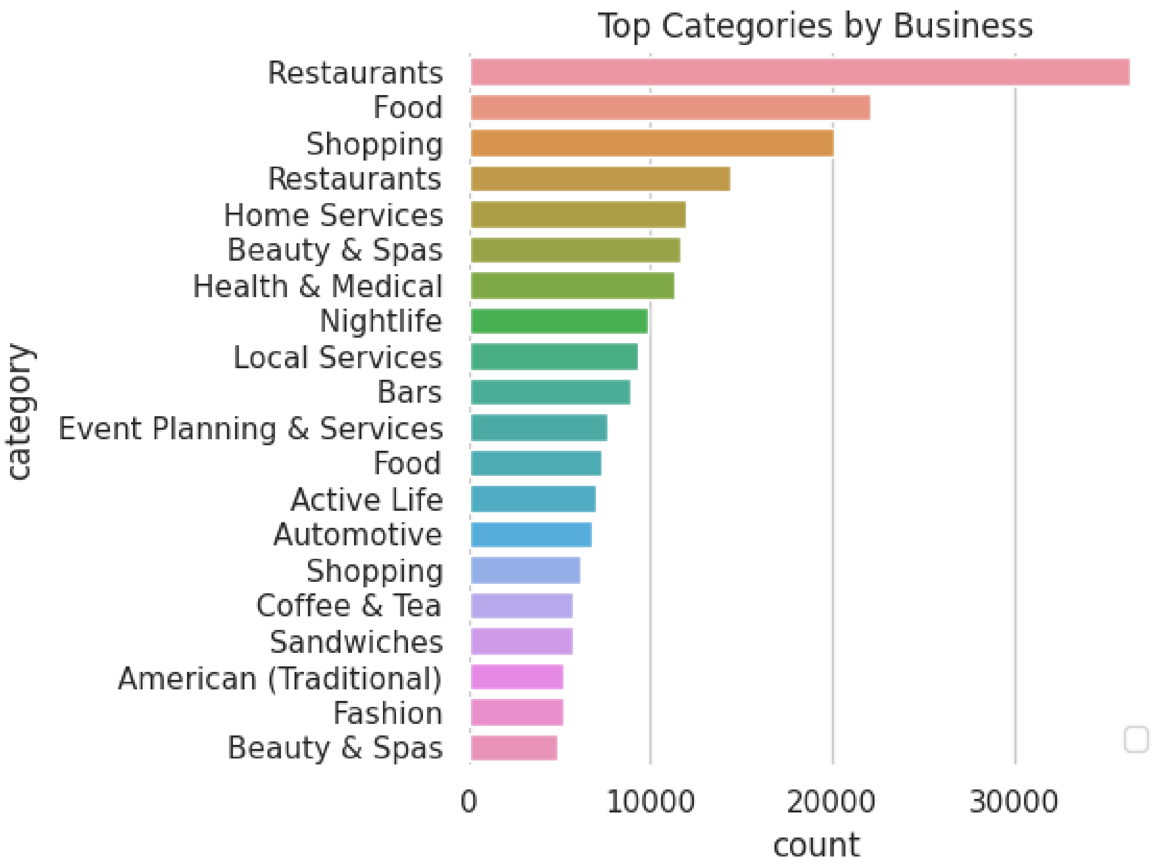
In [14]:

```
result_pdf = barchart_df.limit(20).toPandas()
```

Bar Chart of Top Categories

In [18]:

```
sns.set(style="whitegrid", color_codes=True)

sns.barplot(result_pdf['distinct_count'],result_pdf['categories'])
plt.title('Top Categories by Business')
plt.xlabel('count')
plt.ylabel('category')
plt.tight_layout()
plt.legend('')
plt.box(False)
%matplot plt
```



In [14]:

```
<string>:1: MatplotlibDeprecationWarning: Passing the block parameter of show
() positionally is deprecated since Matplotlib 3.1; the parameter will become
keyword-only in 3.3.
```

Do Yelp Reviews Skew Negative?

Loading Review Data

In [5]:

```
review_df = spark.read.json('s3://sta9760-spark-s3-dataset/yelp/yelp_academic_
review_df.printSchema()
```

```
root
 |-- business_id: string (nullable = true)
 |-- cool: long (nullable = true)
 |-- date: string (nullable = true)
 |-- funny: long (nullable = true)
 |-- review_id: string (nullable = true)
 |-- stars: double (nullable = true)
 |-- text: string (nullable = true)
 |-- useful: long (nullable = true)
 |-- user_id: string (nullable = true)
```

In [4]:

```
review_df.select('business_id','stars').show(5)
```

```
+--------------------+-----+
|         business_id|stars|
+--------------------+-----+
|buF9druCkbuXLX526...|  4.0|
|RA4V8pr014UyUbDvI...|  4.0|
|_sS2LBIGNT5NQb6PD...|  5.0|
|0AzLzHfOJgL7ROwhd...|  2.0|
|8zehGz9jnxPqXtOc7...|  4.0|
+--------------------+-----+
only showing top 5 rows
```

calculating Average Star Rating per Business

In [7]:

```
review_avg_df=review_df.groupBy("business_id").agg({'stars':'avg'})
review_avg_df.show(5)
```

```
+--------------------+------------------+
|         business_id|        avg(stars)|
+--------------------+------------------+
|yHtuNAlYKtRZniO8O...| 4.714285714285714|
|R0IJhEI-zSJpYT1YN...| 3.606060606060606|
|uEUweopM30lHcVxjO...|               3.0|
|L3WCfeVozu5etMhz4...|               4.2|
|XzXcpPCb8Y5huklEN...| 4.666666666666667|
+--------------------+------------------+
only showing top 5 rows
```

In [12]:

```
bus_rvw_join = df.join(review_avg_df, df.business_id == review_avg_df.busines
bus_rvw_join.show()
```

```
+------------------+-----+--------------------+---------------+-----+
|        avg(stars)|stars|                name|           city|state|
+------------------+-----+--------------------+---------------+-----+
|               5.0|  5.0|    CheraBella Salon|        Peabody|   MA|
|             3.875|  4.0|Mezcal Cantina & ...|       Columbus|   OH|
|3.8666666666666667|  4.0|    Red Table Coffee|         Austin|   TX|
|               5.0|  5.0|          WonderWell|         Austin|   TX|
|             3.375|  3.5|         Avalon Oaks|     Wilmington|   MA|
|               1.8|  2.0|Allstate Insuranc...|         Austin|   TX|
|               4.2|  4.0|Divine Frozen Yogurt|   Happy Valley|   OR|
|2.5454545454545454|  2.5|Glendale Square M...|        Everett|   MA|
| 3.774193548387097|  4.0| ONE Boulder Fitness|        Boulder|   CO|
|               5.0|  5.0|    Mel's Frame Shop|       Portland|   OR|
| 2.857142857142857|  3.0|              Subway|        Orlando|   FL|
|1.8392857142857142|  2.0|  Metro Credit Union|        Chelsea|   MA|
|           4.34375|  4.5|MudPuddles Toys &...|       Portland|   OR|
|3.6744186046511627|  3.5|House of Tibet Ki...|     Somerville|   MA|
|4.2075471698113205|  4.0|       Anzen Hiroshi|       Portland|   OR|
|               5.0|  5.0|Maya Strom FNP-C,...|       Portland|   OR|
| 2.693548387096774|  3.0|Two Men and a Tru...|     Wilmington|   MA|
|               3.4|  3.5| EDC Mobile Mechanic|     East Point|   GA|
| 3.577777777777778|  3.5|Krua Thai Restaurant|North Vancouver|   BC|
|               4.8|  5.0|  Hair Passion Salon|        medford|   MA|
+------------------+-----+--------------------+---------------+-----+
only showing top 20 rows
```

Review Data Skew Analaysis

In [20]:

```
from pyspark.sql.functions import udf
from pyspark.sql.types import *
def skew_calc(val1, val2):
    return ((val2 - val1)/val1)

udf_skew = udf(skew_calc,FloatType())

skew_df=bus_rvw_join.withColumn('skew', udf_skew(bus_rvw_join["stars"], bus_r
skew_df.show(5)
```

```
+------------------+-----+--------------------+----------+-----+------------+
|        avg(stars)|stars|                name|      city|state|        skew|
+------------------+-----+--------------------+----------+-----+------------+
|               5.0|  5.0|    CheraBella Salon|   Peabody|   MA|         0.0|
|             3.875|  4.0|Mezcal Cantina & ...|  Columbus|   OH|    -0.03125|
|3.8666666666666667|  4.0|    Red Table Coffee|    Austin|   TX|-0.033333335|
|               5.0|  5.0|          WonderWell|    Austin|   TX|         0.0|
|             3.375|  3.5|         Avalon Oaks|Wilmington|   MA|-0.035714287|
+------------------+-----+--------------------+----------+-----+------------+
only showing top 5 rows
```

In [22]:

```
skew_df.select('skew').describe().show()
```

```
+-------+--------------------+
|summary|                skew|
+-------+--------------------+
|  count|              160585|
|   mean|0.001144303735425...|
| stddev| 0.05142372026270017|
|    min|         -0.37142858|
|    max|           0.8888889|
+-------+--------------------+
```

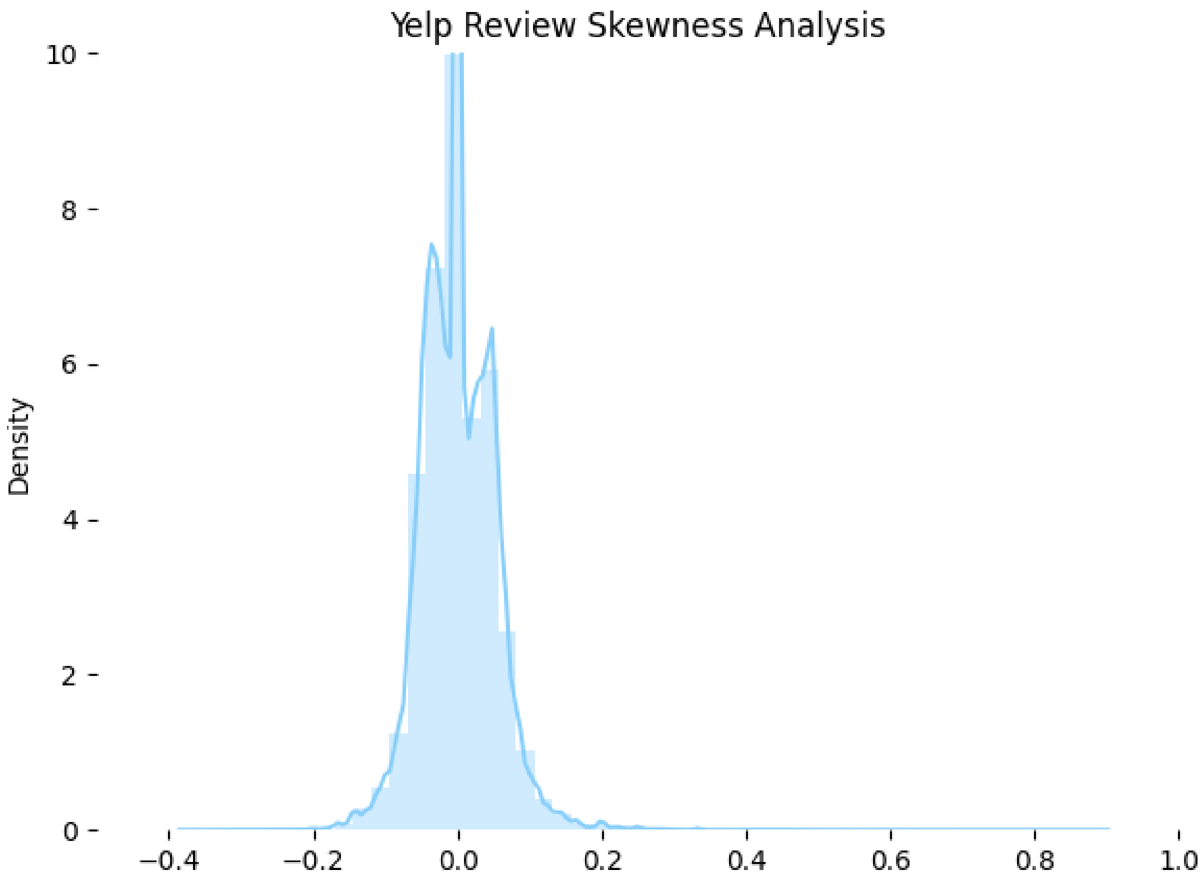
In [27]:

```
skewdfPandas = skew_df.select('skew').toPandas()
```

In [28]:

```
plt.clf()
plt.figure()
ax = sns.distplot(skewdfPandas,color="lightskyblue")
sns.set_style("white")
```

```
ax.set_title('Yelp Review Skewness Analysis')
plt.tight_layout()
plt.box(False)
plt.xlim(-0.5, 1)
plt.ylim(0, 10)
%matplot plt
```



Skew Analysis

So, do Yelp (written) Reviews skew negative? Does this analysis actually prove anything? Expound on implications / interpretations of this graph.

Answer: Most of the pints distributed close to 0 and also We can observer a slightly negative skewness.So we can say,Yelp reviews are slightly negative. But, we also need to look at other variables to support the negative skewness, in order to support this we need to plot review amount vs review stars.

Let us see how stars and reviews variable co-related by printing co-relation marix

In [32]:

```
review_df.createOrReplaceTempView('yelp')
corr_review = spark.sql(

'''
SELECT stars, count(*) as reviews
FROM yelp
GROUP by stars
'''
)
corr_review.show(5)
```

```
+-----+-------+
|stars|reviews|
+-----+-------+
|  1.0|1262800|
|  5.0|3814532|
|  2.0| 711378|
|  4.0|1920037|
|  3.0| 926656|
+-----+-------+
```

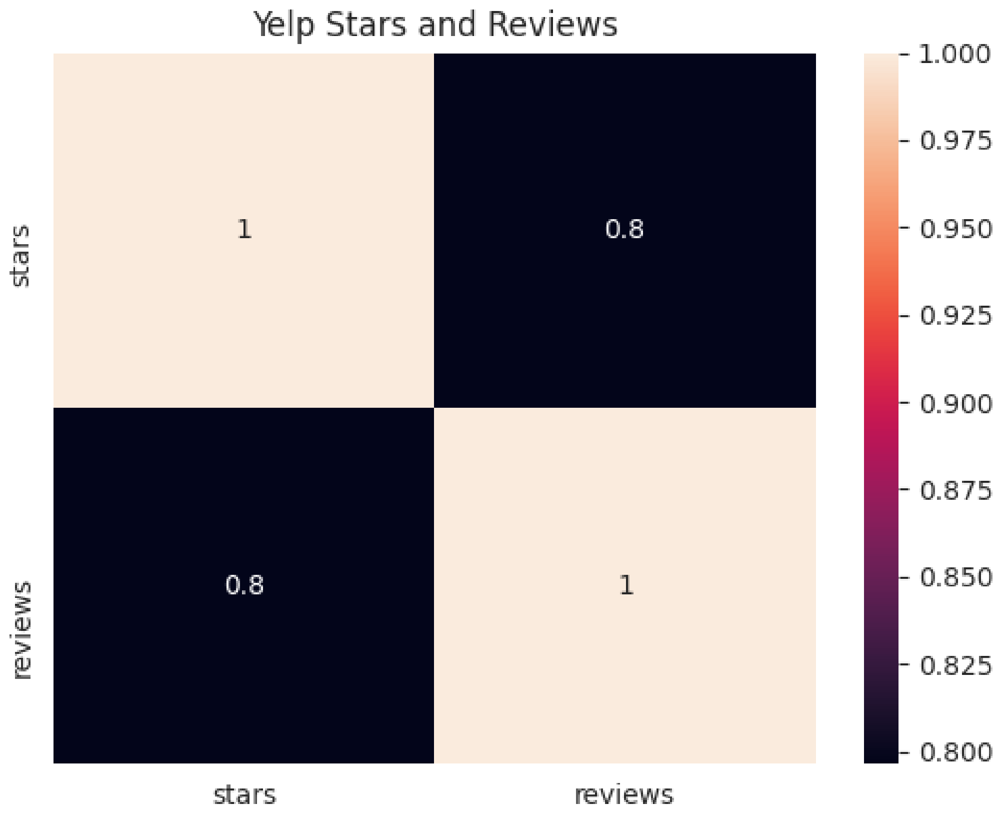
In [33]:

```
corrMatrix = corr_review.toPandas().corr()

print(corrMatrix)
```

```
            stars   reviews
stars    1.000000  0.796355
reviews  0.796355  1.000000
```

In [34]:

```
plt.figure()

sns.heatmap(corrMatrix, annot=True)
plt.title('Yelp Stars and Reviews')
%matplot plt
```



Conclusion:

We see high correlation between number of reviews and number of stars.It means the negative skew on the basis of this data is not entirely true statement.

In [8]:
```
user_df = spark.read.json('s3://sta9760-spark-s3-dataset/yelp/yelp_academic_d
```

Elite User Rating Affect Analysis

User Data Loading

In [6]:
```
user_df.printSchema()
```

```
root
 |-- average_stars: double (nullable = true)
 |-- compliment_cool: long (nullable = true)
 |-- compliment_cute: long (nullable = true)
 |-- compliment_funny: long (nullable = true)
 |-- compliment_hot: long (nullable = true)
 |-- compliment_list: long (nullable = true)
 |-- compliment_more: long (nullable = true)
 |-- compliment_note: long (nullable = true)
 |-- compliment_photos: long (nullable = true)
 |-- compliment_plain: long (nullable = true)
 |-- compliment_profile: long (nullable = true)
 |-- compliment_writer: long (nullable = true)
 |-- cool: long (nullable = true)
 |-- elite: string (nullable = true)
 |-- fans: long (nullable = true)
 |-- friends: string (nullable = true)
 |-- funny: long (nullable = true)
 |-- name: string (nullable = true)
 |-- review_count: long (nullable = true)
 |-- useful: long (nullable = true)
 |-- user_id: string (nullable = true)
 |-- yelping_since: string (nullable = true)
```

In [20]:
```
bus_rvw_ujoin = review_df.join(review_avg_df, review_df.business_id == review_
bus_rvw_ujoin.show(5)
```

```
+--------------------+----+-------------------+-----+--------------------+----
-+--------------------+------+--------------------+--------------------+------
----+
|         business_id|cool|               date|funny|           review_id|star
s|                text|useful|             user_id|         business_id|avg(st
ars)|
+--------------------+----+-------------------+-----+--------------------+----
-+--------------------+------+--------------------+--------------------+------
----+
|--JuLhLvq3gyjNnXT...|   0|2014-11-02 02:09:04|    0|mNF2kv3FFF1Oqy2yZ...|  5.
0|I am new to the a...|     1|4W3RuXRMCwkEu2rBX...|--JuLhLvq3gyjNnXT...|
5.0|
|--JuLhLvq3gyjNnXT...|   0|2012-10-24 17:32:51|    2|E-ue43e-4_H20BgSq...|  5.
0|I was a regular c...|     2|5Cw4tptaueIOpo2Ng...|--JuLhLvq3gyjNnXT...|
5.0|
|--JuLhLvq3gyjNnXT...|   0|2013-03-11 18:38:22|    0|SKpMSlJy85cLhTxxU...|  5.
0|Cherie is fantast...|     2|v0Q2hF7mQeBOLKSXh...|--JuLhLvq3gyjNnXT...|
5.0|
|--JuLhLvq3gyjNnXT...|   0|2017-03-02 17:42:20|    0|2exEVE2AQzUYJVzJP...|  5.
0|I have been going...|     0|QBX6gl83h4ngit64l...|--JuLhLvq3gyjNnXT...|
5.0|
|--JuLhLvq3gyjNnXT...|   0|2017-01-27 17:40:57|    0|huSJ4SW1OiNQvFIdB...|  5.
0|I was lucky enoug...|     0|SHT2OYgOsmuypUbQz...|--JuLhLvq3gyjNnXT...|
5.0|
+--------------------+----+-------------------+-----+--------------------+----
-+--------------------+------+--------------------+--------------------+------
----+
only showing top 5 rows
```

In [23]:

```
user_intrm_review_df=user_df.join(bus_rvw_ujoin, on="user_id", how="inner")

user_review_df=user_intrm_review_df.select('avg(stars)','stars', 'elite','rev
user_review_df.show(5)
```

```
+-----------------+-----+-----+------------+
|       avg(stars)|stars|elite|review_count|
+-----------------+-----+-----+------------+
|4.657407407407407|  5.0|     |          12|
|4.470588235294118|  5.0|     |          11|
|4.196113074204947|  5.0|     |          11|
|3.878260869565217|  1.0|     |          11|
|4.398058252427185|  2.0|     |          11|
+-----------------+-----+-----+------------+
only showing top 5 rows
```

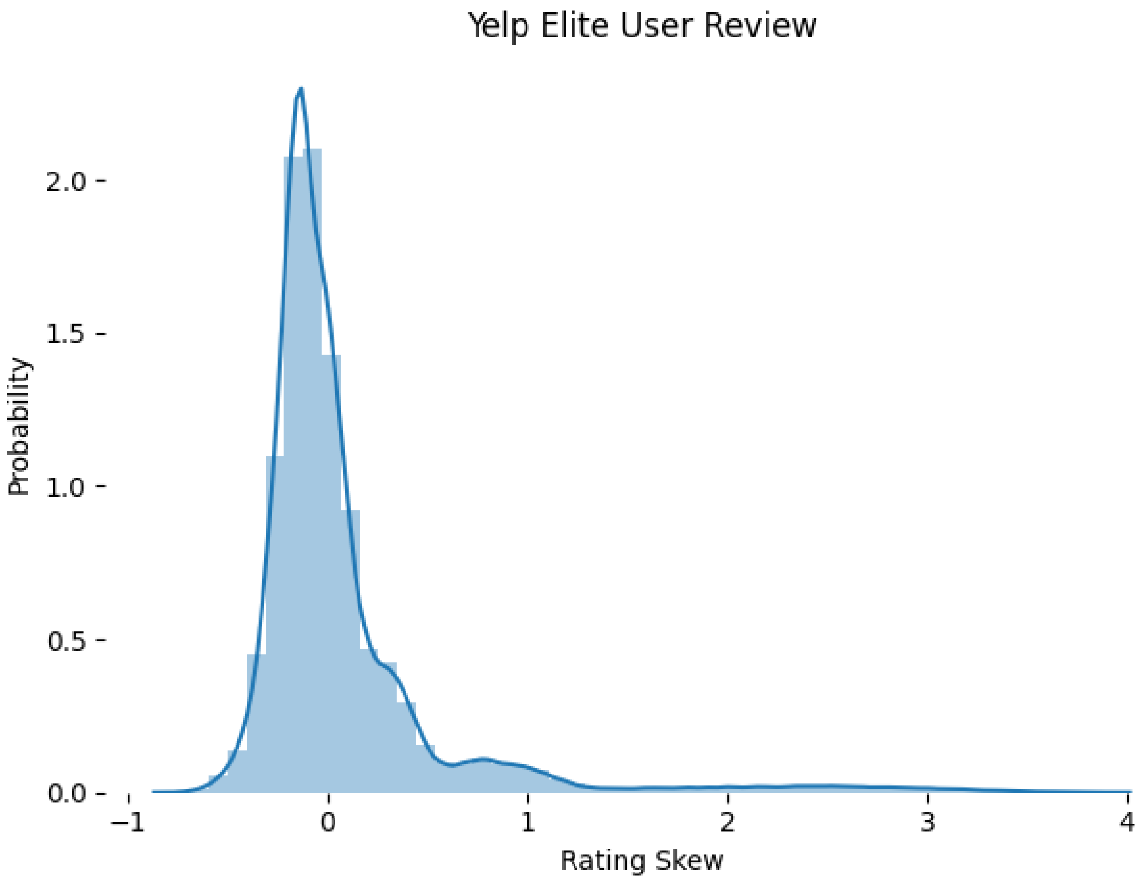
In [26]:

```
import pyspark.sql.functions as F
review_skew = user_review_df.withColumn("skew", F.round((F.col('avg(stars)')-

review_skew.show(5)
```

```
+-----------------+-----+-----+------------+-----+
|       avg(stars)|stars|elite|review_count| skew|
+-----------------+-----+-----+------------+-----+
|4.657407407407407|  5.0|     |          12|-0.07|
|4.470588235294118|  5.0|     |          11|-0.11|
|4.089743589743589|  2.0|     |          11| 1.04|
|3.878260869565217|  1.0|     |          11| 2.88|
|4.398058252427185|  2.0|     |          11|  1.2|
+-----------------+-----+-----+------------+-----+
only showing top 5 rows
```

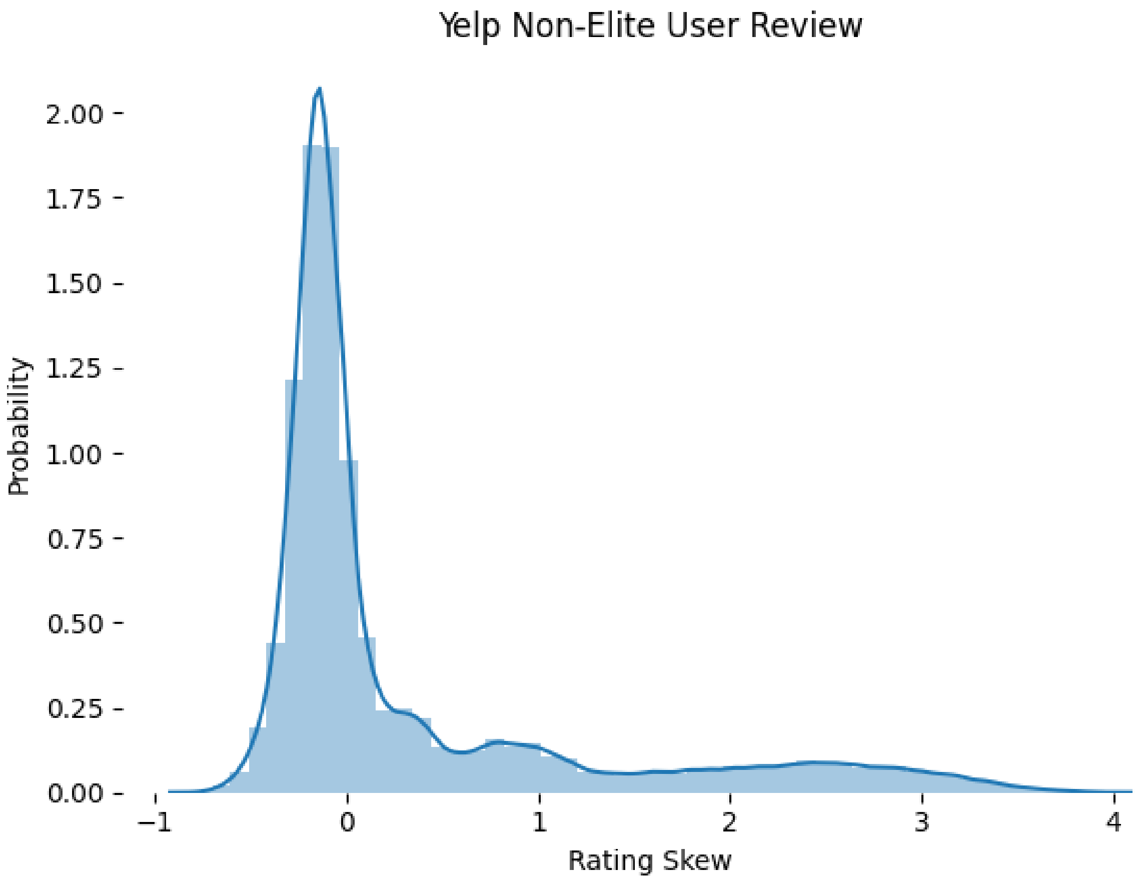
In [30]:

```
elite_review_skew=review_skew.filter(F.col('elite')!='')

result_pdf = elite_review_skew.toPandas()
plt.figure()
sns.distplot(result_pdf['skew'])
plt.title('Yelp Elite User Review')
plt.xlabel('Rating Skew')
plt.ylabel('Probability')
plt.tight_layout()
plt.box(False)
%matplot plt
```



In [33]:

```
non_elite_review_skew=review_skew.filter(F.col('elite')=='')

result_pdf = non_elite_review_skew.toPandas()
plt.figure()
sns.distplot(result_pdf['skew'])
plt.title('Yelp Non-Elite User Review')
plt.xlabel('Rating Skew')
plt.ylabel('Probability')
plt.tight_layout()
plt.box(False)
%matplot plt
```



Conclusion:-

While looking at the skewness of the elite user and others it can be concluded that there is no significant effect of elite user on ratings.