Yelp Restaurants Big Data Analysis Project Tutorial

Introduction

- The goal of this project is to take advantage of the Big Data analysis to capture some valuable insights about the restaurant industry from the 2017 Yelp challenge data set.
- Yelp is a social networking site that lets users post reviews and rate businesses.
- Since its inception in 2004, Yelp has collected a staggering 142 million reviews from users for local businesses. They have an average of 145 million unique visitors to their site every month.
- Restaurants is the 2nd largest business category on Yelp and can provide many interesting insights for analysis.

Objectives

The objective of this tutorial is to provide step-by-step instructions for Big Data Analysis of Restaurants in the 2017 Yelp challenge data set. In this tutorial you will learn how to:

- Download and extract the data set from Yelp
- Upload JSON files to HDFS using Ambari
- Install Rcongui SerDe
- Create tables and queries using HiveQL
- Export results and visualize them in Tableau

Step 1: Data Preparation

1) Download the data and extract it from http://bit.ly/SKT_COMB_LAB

   Data set size:
   1 TAR file - 2.28 GB compressed
   6 JSON files - 5.79 GB uncompressed

The included files are: business, reviews, user, check-in, tip and photos.

2) Use shell terminal or gitbash to untar yelp_dataset.tar.gz file
   - gitbash: http://www.techoism.com/how-to-install-git-bash-on-windows/
   - tar -zxvf yelp_dataset.tar
     - will generate 6 jsons and some pdf fiels: ./dataset/business.json, checkin.json, photos.json, review.json, tip.json, user.json
3) Since Yelp data set is of high quality it is not necessary to perform any data cleaning.

Step 2: Uploading Data to HDFS For Storage and Analysis

1. Login as user training. You will work from this account for the remaining lab.
2. Create Yelp folder in your HDFS home directory. You can use Hue or HDFS.

```
hdfs dfs -mkdir /user/training/yelp
```

3. Create separate folders inside the Yelp directory for each JSON file:
    - business, review, users, tip, checkin

```
hdfs dfs -mkdir /user/training/yelp/business
hdfs dfs -mkdir /user/training/yelp/review
hdfs dfs -mkdir /user/training/yelp/users
hdfs dfs -mkdir /user/training/yelp/tip
hdfs dfs -mkdir /user/training/yelp/checkin
```

4. Use Hue or the HDFS command line to “put” the json files in their respective directories

Step 3: Adding RCONGUI JSON SerDe

We will need support to read] JSON arrays, maps and nested structures, since our data set contains a lot of nested attributes. Rcongui is one of the available tools to accomplish this. Please refer to this for more information and other options.

https://community.cloudera.com/t5/Batch-SQL-Apache-Hive/Create-Hive-Table-from-JSON-Files/td-p/64006

https://community.cloudera.com/t5/Cloudera-Manager-Installation/Hive-Aux-Jars-path-With-Cloudera-Manager-Clusters/td-p/18232

https://stackoverflow.com/questions/19135869/best-place-for-json-serde-jar-in-cdh-hadoop-for-use-with-hive-hue-mapreduce

1. Download two JAR files from http://www.congiu.net/hive-json-serde/ into your HDFS Cluster

```
wget -O json-serde-1.3.8-jar-with-dependencies.jar  \
www.congiu.net/hive-json-serde/1.3.8/cdh5/json-serde-1.3.8-jar-with-dependencies.jar

wget -O json-udf-1.3.8-jar-with-dependencies.jar  \
www.congiu.net/hive-json-serde/1.3.8/cdh5/json-udf-1.3.8-jar-with-dependencies.jar
```

If the files have successfully been uploaded you will see the following confirmation:

```
-bash-4.1$ wget -O json-serde-1.3.8-jar-with-dependencies.jar  www.congiu.net/hiv
e-json-serde/1.3.8/hdp23/json-serde-1.3.8-jar-with-dependencies.jar;
--2017-10-26 01:08:08--  http://www.congiu.net/hive-json-serde/1.3.8/hdp23/json-s
erde-1.3.8-jar-with-dependencies.jar
Resolving www.congiu.net... 64.90.44.101
Connecting to www.congiu.net|64.90.44.101|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 85492 (83K) [application/java-archive]
Saving to: "json-serde-1.3.8-jar-with-dependencies.jar"

100%[======================================>] 85,492      330K/s   in 0.3s

2017-10-26 01:08:08 (330 KB/s) - "json-serde-1.3.8-jar-with-dependencies.jar" sav
ed [85492/85492]
```

```
-bash-4.1$ wget -O json-udf-1.3.8-jar-with-dependencies.jar www.congiu.net/hive-j
son-serde/1.3.8/hdp23/json-udf-1.3.8-jar-with-dependencies.jar
--2017-10-26 01:10:03--  http://www.congiu.net/hive-json-serde/1.3.8/hdp23/json-u
df-1.3.8-jar-with-dependencies.jar
Resolving www.congiu.net... 64.90.44.101
Connecting to www.congiu.net|64.90.44.101|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2275 (2.2K) [application/java-archive]
Saving to: "json-udf-1.3.8-jar-with-dependencies.jar"

100%[======================================>] 2,275       --.-K/s   in 0s

2017-10-26 01:10:03 (495 MB/s) - "json-udf-1.3.8-jar-with-dependencies.jar" saved
 [2275/2275]
```

2. Add the following at the beginning of each HIVE session:

```
ADD JAR json-serde-1.3.8-jar-with-dependencies.jar;
ADD JAR json-udf-1.3.8-jar-with-dependencies.jar;
```

```
hive> ADD JAR json-serde-1.3.8-jar-with-dependencies.jar;
Added [json-serde-1.3.8-jar-with-dependencies.jar] to class path
Added resources: [json-serde-1.3.8-jar-with-dependencies.jar]
hive>
```

You need to do this every HIVE session!!!! Otherwise the following error will be displayed:

```
FAILED: RuntimeException MetaException(message:java.lang.ClassNotFoundException
Class org.openx.data.jsonserde.JsonSerDe not found)
hive>
```

If you get any SerDe error, it is necessary to reenter these again, if you get out of HIVE, then you need to enter again when you start hive

3. Optionally you can enter the following in HIVE to see the query column names displayed

```
set hive.cli.print.header=true;
```

Step 4: Creating Tables in HIVE

The following Hive statements create external tables that allows Hive to query data stored in HDFS. Since we are using JSON Serde it is important to include the following format when creating each table:

ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'

Additionally, if you followed the instructions above and have your JSON data file in the respective folder the following statement will automatically load the data into your tables:

LOCATION '/user/training/yelp/folder_name';

Optional: You may choose to try Tableau with a free trial of 30 days. Tableau has a nice tutorial that you can try to quickly learn the basics. The maximum JSON file size that can be uploaded directly to Tableau is 128MB and the files in our data set such as for example review.json and users.json files are 3.5GB and 1.5GB in size respectively, we will use HDFS to create smaller tables and queries and that can be exported to Tableau for visualizations.

I. Create Restaurants Table

Follow the following procedure to create Restaurants table from business.json file:

TABLE 1: Create initial BUSINESS table (with all categories and attributes included)

```
CREATE EXTERNAL TABLE business4 (
address string,
business_id string,
categories array<string>,
city string,
hours struct<friday:string, monday:string, saturday:string, sunday:string, thursday:string, tuesday:string, wednesday:string>,
is_open int,
latitude double,
```

```
longitude double,
name string,
neighborhood string,
postal_code string,
review_count int,
stars double,
state string,
Attributes struct<
Accepts_Insurance:boolean,
Ages_Allowed:string,
Alcohol:string,
Bike_Parking:boolean,
Business_Accepts_Bitcoin:boolean,
Business_Accepts_Credit_Cards:boolean,
By_Appointment_Only:boolean,
Byob:boolean,
BYOB_Corkage:string,
Caters:boolean,
Coat_Check:boolean,
Corkage:boolean,
Dogs_Allowed:boolean,
Drive_Thru:boolean,
Good_For_Dancing:boolean,
Good_For_Kids:boolean,
Happy_Hour:boolean,
Has_TV:boolean,
Noise_Level:string,
Open24Hours:boolean,
Outdoor_Seating:boolean,
Restaurants_Attire:string,
Restaurants_Counter_Service:boolean,
```

Restaurants_Delivery:boolean,
Restaurants_Good_For_Groups:boolean,
Restaurants_Reservations:boolean,
Restaurants_Table_Service:boolean,
Restaurants_Take_Out:boolean,
Smoking:string,
WheelchairAccessible:boolean,
WiFi:string,
Ambience:struct<
Casual:boolean,
Classy:boolean,
Divey:boolean,
Hipster:boolean,
Intimate:boolean,
Romantic:boolean,
Touristy:boolean,
Trendy:boolean,
Upscale:boolean>,
BestNights:struct<
Friday1:boolean,
Monday1:boolean,
Saturday1:boolean,
Sunday1:boolean,
Thursday1:boolean,
Tuesday1:boolean,
Wednesday1:boolean>,
BusinessParking:struct<
Garage:boolean,
Lot:boolean,
Street:boolean,
Valet:boolean,

Validated:boolean>,
DietaryRestrictions:struct<
Dairy_Free:boolean,
Gluten_Free:boolean,
Halal:boolean,
Kosher:boolean,
Soy_Free:boolean,
Vegan:boolean,
Vegetarian:boolean>,
GoodForMeal:struct<
Breakfast:boolean,
Brunch:boolean,
Dessert:boolean,
Dinner:boolean,
Latenight:boolean,
Lunch:boolean>,
HairSpecializesIn:struct<
Africanamerican:boolean,
Asian:boolean,
Coloring:boolean,
Curly:boolean,
Extensions:boolean,
Kids:boolean,
Perms:boolean,
Straightperms:boolean>,
Music:struct<
BackgroundMusic:boolean,
Dj:boolean,
Jukebox:boolean,
Karaoke:boolean,
Live:boolean,

```
NoMusic:boolean,
Video:boolean>,
restaurantspricerange2:int>)
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/training/yelp/business';
```

To verify that your table was created properly and data was loaded you can test your table as following:

1. Verify total number of businesses in the data set:

```
SELECT count(business_id) FROM business4;
```

```
OK
_c0
156639
Time taken: 43.331 seconds, Fetched: 1 row(s)
hive>
```

2. Take a look at your data

```
SELECT * FROM business4;
```

```
hive> select * from business4 limit 1;
OK
business4.address       business4.business_id   business4.categories    business
4.city  business4.hours business4.is_open       business4.latitude      business
4.longitude     business4.name  business4.neighborhood  business4.postal code  b
usiness4.review_count   business4.stars business4.state business4.attributes
691 Richmond Rd YDf95gJZaq05wvo7hTQbbQ  ["Shopping","Shopping Centers"] Richmond
 Heights        {"friday":"10:00-21:00","monday":"10:00-21:00","saturday":"10:00
-21:00","sunday":"11:00-18:00","thursday":"10:00-21:00","tuesday":"10:00-21:00",
"wednesday":"10:00-21:00"}      1       41.5417162      -81.4931165     Richmond
 Town Square            44143   17      2.0     OH      {"accepts_insurance":nul
l,"ages_allowed":null,"alcohol":null,"bike_parking":null,"business_accepts_bitco
in":null,"business_accepts_credit_cards":null,"by_appointment_only":null,"byob":
null,"byob_corkage":null,"caters":null,"coat_check":null,"corkage":null,"dogs_al
lowed":null,"drive_thru":null,"good_for_dancing":null,"good_for_kids":null,"happ
y_hour":null,"has_tv":null,"noise_level":null,"open24hours":null,"outdoor_seatin
g":null,"restaurants_attire":null,"restaurants_counter_service":null,"restaurant
s_delivery":null,"restaurants_good_for_groups":null,"restaurants_reservations":n
ull,"restaurants_table_service":null,"restaurants_take_out":null,"smoking":null,
"wheelchairaccessible":true,"wifi":null,"ambience":null,"bestnights":null,"busin
essparking":{"garage":false,"lot":true,"street":false,"valet":false,"validated":
false},"dietaryrestrictions":null,"goodformeal":null,"hairspecializesin":null,"m
usic":null,"restaurantspricerange2":2}
Time taken: 0.227 seconds, Fetched: 1 row(s)
hive>
```

```
DESCRIBE business4;
```

```
hive> describe business4;
OK
col_name        data_type       comment
address                 string                  from deserializer
business_id             string                  from deserializer
categories              array<string>           from deserializer
city                    string                  from deserializer
hours                   struct<friday:string,monday:string,saturday:string,sunda
y:string,thursday:string,tuesday:string,wednesday:string>       from deserialize
r
is_open                 int                     from deserializer
latitude                double                  from deserializer
longitude               double                  from deserializer
name                    string                  from deserializer
neighborhood            string                  from deserializer
postal_code             string                  from deserializer
review_count            int                     from deserializer
stars                   double                  from deserializer
state                   string                  from deserializer
attributes              struct<accepts_insurance:boolean,ages_allowed:string,alc
ohol:string,bike_parking:boolean,business_accepts_bitcoin:boolean,business_accep
ts_credit_cards:boolean,by_appointment_only:boolean,byob:boolean,byob_corkage:st
ring,caters:boolean,coat_check:boolean,corkage:boolean,dogs_allowed:boolean,driv
e_thru:boolean,good_for_dancing:boolean,good_for_kids:boolean,happy_hour:boolean
,has_tv:boolean,noise_level:string,open24hours:boolean,outdoor_seating:boolean,r
estaurants_attire:string,restaurants_counter_service:boolean,restaurants_deliver
y:boolean,restaurants_good_for_groups:boolean,restaurants_reservations:boolean,r
estaurants_table_service:boolean,restaurants_take_out:boolean,smoking:string,whe
elchairaccessible:boolean,wifi:string,ambience:struct<casual:boolean,classy:bool
ean,divey:boolean,hipster:boolean,intimate:boolean,romantic:boolean,touristy:boo
lean,trendy:boolean,upscale:boolean>,bestnights:struct<friday1:boolean,monday1:b
oolean,saturday1:boolean,sunday1:boolean,thursday1:boolean,tuesday1:boolean,wedn
esday1:boolean>,businessparking:struct<garage:boolean,lot:boolean,street:boolean
,valet:boolean,validated:boolean>,dietaryrestrictions:struct<dairy_free:boolean,
gluten_free:boolean,halal:boolean,kosher:boolean,soy_free:boolean,vegan:boolean,
vegetarian:boolean>,goodformeal:struct<breakfast:boolean,brunch:boolean,dessert:
boolean,dinner:boolean,latenight:boolean,lunch:boolean>,hairspecializesin:struct
<africanamerican:boolean,asian:boolean,coloring:boolean,curly:boolean,extensions
:boolean,kids:boolean,perms:boolean,straightperms:boolean>,music:struct<backgrou
ndmusic:boolean,dj:boolean,jukebox:boolean,karaoke:boolean,live:boolean,nomusic:
boolean,video:boolean>,restaurantspricerange2:int>      from deserializer
Time taken: 0.086 seconds, Fetched: 15 row(s)
hive>
```

After create the table in Hive, you may want to execute your queries in Impala. Give it a try. What did you get? (Error message that the JSON serde is not supported) In order to query using Impala, it is best to convert the format to Parquet. The easiest way to do this is to create another table in Hive using CTAS and saving the format as Parquet. For example:

```
CREATE TABLE biz4
STORED AS PARQUET
AS SELECT * FROM business4;
```

TABLE 2: Create EXPLODED table with flattened categories

Since our file contains an array of categories we need to flatten those categories in order to be able to query them easily. We use LATERAL VIEW explode function for this purpose as following:

```
CREATE TABLE exploded
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/training/yelp/business/exploded'
AS
```

```
SELECT * FROM business4 LATERAL VIEW explode(categories) c AS cat_exploded;
```

1. To verify that your table was created properly and data was loaded you can test your table as following:

```
SELECT * FROM exploded LIMIT 1;
```

```
hive> select * from exploded limit 1;
OK
exploded.address        exploded.business_id    exploded.categories     exploded
.city   exploded.hours  exploded.is_open        exploded.latitude       exploded
.longitude      exploded.name   exploded.neighborhood   exploded.postal_code   e
xploded.review_count    exploded.stars  exploded.state  exploded.attributes    e
xploded.cat_exploded
691 Richmond Rd YDf95gJZaq05wvo7hTQbbQ  ["Shopping","Shopping Centers"] Richmond
 Heights        {"friday":"10:00-21:00","monday":"10:00-21:00","saturday":"10:00
-21:00","sunday":"11:00-18:00","thursday":"10:00-21:00","tuesday":"10:00-21:00",
"wednesday":"10:00-21:00"}      1       41.5417162      -81.4931165     Richmond
 Town Square            44143   17      2.0     OH      {"accepts_insurance":nul
l,"ages_allowed":null,"alcohol":null,"bike_parking":null,"business_accepts_bitco
in":null,"business_accepts_credit_cards":null,"by_appointment_only":null,"byob":
null,"byob_corkage":null,"caters":null,"coat_check":null,"corkage":null,"dogs_al
lowed":null,"drive_thru":null,"good_for_dancing":null,"good_for_kids":null,"happ
y_hour":null,"has_tv":null,"noise_level":null,"open24hours":null,"outdoor_seatin
g":null,"restaurants_attire":null,"restaurants_counter_service":null,"restaurant
s_delivery":null,"restaurants_good_for_groups":null,"restaurants_reservations":n
ull,"restaurants_table_service":null,"restaurants_take_out":null,"smoking":null,
"wheelchairaccessible":true,"wifi":null,"ambience":null,"bestnights":null,"busin
essparking":{"garage":false,"lot":true,"street":false,"valet":false,"validated":
false},"dietaryrestrictions":null,"goodformeal":null,"hairspecializesin":null,"m
usic":null,"restaurantspricerange2":2}  Shopping
Time taken: 0.362 seconds, Fetched: 1 row(s)
hive>
```

2. Verify that total number of businesses in the data set is the same as before:

```
SELECT count (DISTINCT business_id) number_businesses FROM exploded;
```

```
OK
number_businesses
156261
Time taken: 38.898 seconds, Fetched: 1 row(s)
hive>
```

3. To find the number of restaurants in the dataset:

```
SELECT count (business_id) number_restaurants FROM exploded
WHERE cat_exploded="Restaurants";
```

```
OK
number_restaurants
51613
Time taken: 35.564 seconds, Fetched: 1 row(s)
hive>
```

TABLE 3: Create RESTAURANTS table

This is our final table which contains only restaurants.

```
CREATE TABLE restaurants
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/mboldin/yelp/business/restaurants'
AS
SELECT * FROM exploded WHERE cat_exploded="Restaurants";
```

To verify that your restaurants table was created properly you can test your table as following:

```
SELECT name, review_count, stars, cat_exploded category FROM restaurants LIMIT 5;
```

```
hive> select name, review_count, stars, cat_exploded category from restaurants l
imit 5;
OK
name    review_count    stars   category
South Florida Style Chicken & Ribs      4       4.5     Restaurants
Blimpie 10      4.5     Restaurants
Applebee's      21      2.0     Restaurants
China Garden    3       3.0     Restaurants
Rocky's 15      3.0     Restaurants
Time taken: 0.103 seconds, Fetched: 5 row(s)
hive>
```

NOTE ON USING SerDe FOR QUERING NESTED DATA OBJECTS:

Since as mentioned before, our data set contains multiple nested attributes, you can use the following format to query them.

a) To select nested columns it works as following:

parent.child.grandchild

```
SELECT name, attributes.ambience.romantic FROM restaurants LIMIT 5;
```

```
hive> select name, attributes.ambience.romantic from restaurants limit 5;
OK
name    romantic
South Florida Style Chicken & Ribs      false
Blimpie false
Applebee's      false
China Garden    NULL
Rocky's false
Time taken: 0.102 seconds, Fetched: 5 row(s)
```

b) To query BOOLEAN values from nested objects:

```
SELECT name, state, city, attributes.ambience.romantic romantic FROM restaurants
WHERE attributes.ambience.romantic = true LIMIT 10;
```

```
hive> select name, state, city, attributes.ambience.romantic romantic  from re
aurants where attributes.ambience.romantic == true limit 10;
OK
name    state   city    romantic
Ristorante Beatrice     QC      Montreal        true
Verona Chophouse        AZ      Chandler        true
Bass Lake Taverne Inn   OH      Chardon true
Edulis  ON      Toronto true
Edge Steakhouse NV      Las Vegas       true
Caffe Boa Ahwatukee     AZ      Phoenix true
White Oaks      OH      Westlake        true
Latinada Tapas Restaurant       ON      Toronto true
Chez Chose      QC      Montréal        true
The Keg Steakhouse + Bar        AZ      Chandler        true
Time taken: 8.106 seconds, Fetched: 10 row(s)
```

II. Create Review Table

Table 4: Create Review Table

```
CREATE EXTERNAL TABLE review (
  business_id string,
  cool int,
  review_date string,
  funny  int,
  review_id string,
  stars int,
  text string,
  useful int,
  user_id string)
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/training/yelp/review';
```

```
    > CREATE EXTERNAL TABLE review (
    >   business_id string,
    >   cool int,
    >   review_date string,
    >   funny int,
    >   review_id string,
    >   stars int,
    >   text string,
    >   useful int,
    >   user_id string)
    > ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
    > LOCATION '/user/mboldin/yelp/review';
OK
Time taken: 0.836 seconds
hive>
```

```
SELECT * FROM review LIMIT 1;
```

```
OK
review.business_id      review.cool     review.review_date      review.funny    r
eview.review_id review.stars    review.text     review.useful   review.user_id
uYHaNptLzDLoV_JZ_MuzUA  0       NULL    0       VfBHSwC5Vz_pbFluy07i9Q  5       M
y girlfriend and I stayed here for 3 nights and loved it. The location of this h
otel and very decent price makes this an amazing deal. When you walk out the fro
nt door Scott Monument and Princes street are right in front of you, Edinburgh C
astle and the Royal Mile is a 2 minute walk via a close right around the corner,
 and there are so many hidden gems nearby including Calton Hill and the newly op
ened Arches that made this location incredible.

The hotel itself was also very nice with a reasonably priced bar, very considera
te staff, and small but comfortable rooms with excellent bathrooms and showers.
Only two minor complaints are no telephones in room for room service (not a huge
 deal for us) and no AC in the room, but they have huge windows which can be ful
ly opened. The staff were incredible though, letting us borrow umbrellas for the
 rain, giving us maps and directions, and also when we had lost our only UK adap
ter for charging our phones gave us a very fancy one for free.

I would highly recommend this hotel to friends, and when I return to Edinburgh (
which I most definitely will) I will be staying here without any hesitation.   0
cjpdDjZyprfyDG3RlkVG3w
Time taken: 0.06 seconds, Fetched: 1 row(s)
hive>
```

To verify number of reviews in the data set:

```
SELECT count(*) FROM review;
```

```
OK
_c0
4736897
Time taken: 139.758 seconds, Fetched: 1 row(s)
hive>
```

Table 5: Create Review_Filtered Table

```
CREATE TABLE review_filtered

ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'

STORED AS TEXTFILE
```

```
LOCATION '/user/training/yelp/review_filtered'
AS
SELECT re.business_id, r.stars, r.user_id
FROM review r JOIN restaurants re
ON r.business_id = re.business_id;
```

To find the number of restaurant reviews:

```
SELECT count(*) FROM review_filtered;
```

```
hive> select count(*) from review_filtered;
OK
_c0
2927731
Time taken: 0.091 seconds, Fetched: 1 row(s)
hive>
```

III. Create Users Table

Table 6: Create Users Table

```
CREATE EXTERNAL TABLE users (
  average_stars double,
  compliment_cool int,
  compliment_cute int,
  compliment_funny int,
  compliment_hot int,
  compliment_list int,
  compliment_more int,
  compliment_note int,
  compliment_photos int,
  compliment_plain int,
  compliment_profile int,
  compliment_writer int,
  cool int,
  elite array<int>,
  fans int,
```

```
  friends array<string>,
  funny int,
  name string,
  review_count int,
  useful int,
  user_id string,
  yelping_since string)
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
LOCATION '/user/training/yelp/users';
```

```
hive> CREATE EXTERNAL TABLE users (
    >   average_stars double,
    >   compliment_cool int,
    >   compliment_cute int,
    >   compliment_funny int,
    >   compliment_hot int,
    >   compliment_list int,
    >   compliment_more int,
    >   compliment_note int,
    >   compliment_photos int,
    >   compliment_plain int,
    >   compliment_profile int,
    >   compliment_writer int,
    >   cool int,
    >   elite array<int>,
    >   fans int,
    >   friends array<string>,
    >   funny int,
    >   name string,
    >   review_count int,
    >   useful int,
    >   user_id string,
    >   yelping_since string)
    > ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
    > LOCATION '/user/mboldin/yelp/user';
OK
Time taken: 0.117 seconds
hive>
```

```
hive> select * from users limit 1;
OK
users.average_stars     users.compliment_cool   users.compliment_cute   users.co
mpliment_funny  users.compliment_hot    users.compliment_list   users.compliment
_more   users.compliment_note   users.compliment_photos users.compliment_plain u
sers.compliment_profile users.compliment_writer users.cool      users.elite     u
sers.fans       users.friends   users.funny     users.name      users.review_cou
nt      users.useful    users.user_id   users.yelping_since
3.8     5174    284     5174    5175    78      299     1435    7829    7397    5
69      1834    16856   [2014,2016,2013,2011,2012,2015,2010,2017]       209     [
"M19NwFwAXKRZzt8koF11hQ","QRcMZ8pJJBBZaKubHOoMDQ","uimsjcHoBnXz1MAKGvB26w","v325
XGF-l9da74ZMWEjyoA","vP5ajc1oGURsNvCXewsnDw","9nSutZOliE9Vg4XVGEx1HA","--2vR0DIs
mQ6WfcSzKWigw","LDJ51sk5SJXovRI2yQZimA","3R_dB9VQ_D3WPJEw7pmorA","8drMKNHWavs2g6
uf0pLtvg","wOGfOjBaP-lCS1NW_En2LQ","AK2-Pvb6E9vgeXWyY4Jxog","DbUSCSMQwD3eiAre0Ue
u8A","B_2qev6exPELs7ZnO4iljg","LQALTuDeCRLwR9NOxUWS5A","kSUU18CH2BRPLK1uUsz1Wg",
"M-HINGCHOnaQkKq8WDtRMA","9lWyDOySHcc6Jiqp2-EPUw","j2Eu9pE22Rp_DRoSp3KgQg","neuz
9oCcHiW4k-jltcC1BA","PRQxRp1IFHPBlbXeDwG3mA","t9vCxltuXJ941V8ppWVsVQ","pYK8JuByl
omxLIwwyv0Iyw","WTLPH3jIWOUTFMpD4o_7Vg","qAE5pJYa75gRbpC7bgI3Ow","7OxFrOWLP04hSC
GY_g3aUw","nRdfX_I0CaOq7lJunJMPpA","W81-CPVrM9c6F8XiNuEUvA","VaVkC537R46xRNpOucR
gvA","j8YxElKHhbg1ghQDSI1v3Q","sYLXiL6q8eiB-D4e3LfWaw","6ueSDFjnsnr-ypVR15WTRg",
"Mi1VEqRHfJ75ESxPuAV9MQ","itz3iIH8qPpm0RowHZ63cA","Wc5L6iuvSNF5WGBlqIO8nw","zb_8
3ib91kA6jBislfTSoQ","Pt1yV4SQUR_4LYmkynCGww","Nh_o4LibitBckghR1_8CBQ","vGr0B5weD
DNNmx0zQaQVhw","BujvYvqpupySiAD9ykhXqg","dOFyIGbyfB69VB4pnoKqQA","PSflctuopnjaIW
m-P_o7YQ","zGeG-yb2IDKAGeWSZW2Y1Q","nU5-DpWwid61hHtksA2DMQ","KOS4YIWIxYobnym0sn1
esQ","qNrHLZPurBWJzeAMkFLvvA","5YjvvIgBf-65In3AKXnNjw","Izm94TyF60xP4mPDg9oEBw",
"3ePYVkxiMxBBanReYIZuUw","fGQwLxFbo7RGnNoSDnI4Cw","5rDW0VrYEc9-XyuAU4aMHw","vTug
BdYg34rX4KvGpzBrNA","ebYpHPQWSKoxlzCPJFsFjA","a9x2BusJ-E7aG14LYQw3xw","r3XlOUy7F
UpX22Mi-Eo29Q","IXdmrbRu0veA-OuaP0URwQ","fCiXeYNwrwpM2MGilA1ViQ","_pBzBgtCTN9PNU
PfgPDI8A","hZKVx71GlTvg5AaWemQWIQ","4RKq0POQ5jpToRkiiUvJLg","tuIofXv7QuW0GFm-osF
aZA","L-5NjRMaE5KClXYJk8HVcA","o9XzWtzTuV2X9fyYevXmkw","qtUUQNbKlXy02Dr2TPrtZg",
"29XxHvrJAyvuRaPXu_h-QA","mlXIzLHZ2RAw3MMzpBsFlA","-gQm-IoK2_BMEMx9OgtQnw","qU7C
t1nJjLTtXc_J6YgsTA","s81VRLqYFEpXPIQtGx2mnw","418F_vnEiJMlU-sKpGttHA","RNChXr9iN
cYPP0G6zN4gYA","Cg7HLuddh8s6yKpq4SFpVg","zqXNpAw8zMcuNNPsRXxZ9Q","KB5ooQeFAivMFb
BavgH_kg","8U8b1EkLQ66djWVcNYyoRQ","n5wlyjHGoe8JTIJmDoGL9Q","u8WIVYVQxiAFJWLdjJN
kIQ","QuPACjm9M7dMqXbXrE9UWQ","YwaKGmRNnSa3R3N4Hf9jLw","P5wzujlAD8qz-SqpwcUaCQ",
"brqm9p7FMfolAqJgElqGHw","a-Ug_MFryz3utca-NaMkNQ","-UekDWg_Wy4FvxU8l38DIQ","PgKC
Yy3NYMSEIR2IZ1NQRw","OE7LvvZiQgLmNacHJNg-KA","yKNf3fxNiXnZr67FDTLQgw","7OvtYnfsc
IWBahX6hL2xkQ","bQ3BLXeuDtSdSyGNnLo9mA","pPCzUWTqoiAWUF3MyOXDvQ","xgI4uIQiCmM1yC
oJnHtzeA","WRTKHSPSum0sg6HDYM5prw","ajCBUlkRk7sdNqwIgvPh3Q","n6hHjOuv8NAWubj0U7I
FLA","eWLJMa7m_pHRdg1VANIK_Q","DONwuwg9iySZ7LFjtcHdCA","CLmvJN5a3l9KutC-nF6LzA",
"tufuEc5f9TWR05_yko46QQ","_ijx1PqANQVFLGNWCibdig","0bwmSWsi5WZfcDu61ZMGhg","IB0_
DRx-L8O1MtzwPF-lQw","6DC0wklyCCirKpglOOCyow","TwPlaNvnziaN2wB3lk_9Mw","NRRz3KbCS
```

To find the number of all users in dataset:

```
SELECT count(distinct user_id) FROM users;
```

```
OK
c0
1183362
Time taken: 68.755 seconds, Fetched: 1 row(s)
hive>
```

Table 7: Create Elite Users Table

This table allows us to separate elite users only

```
CREATE TABLE elite_users
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/training/yelp/users/elite'
AS
SELECT * FROM users LATERAL VIEW explode(elite) c AS elite_year;
```

IV. Create Tip Table

Table 8: Create Tip Table

```
CREATE EXTERNAL TABLE tip (
text  string,
date_tip string,
likes int,
business_id string,
user_id string)
ROW FORMAT SERDE 'org.openx.data.jsonserde.JsonSerDe'
STORED AS TEXTFILE
LOCATION '/user/mboldin/yelp/tip';
```

Step 4: Create tables and queries using HiveQL and visualize in Hue (or Tableau if you want to try)

We can save the results of HIVE queries in HDFS in form of JSON files. Tableau works really well with nested JSON files, making it easy to visualize the results of analysis.

To create visualizations in Tableau we have 2 options:

- If JSON file size is less than 128MB we can upload it directly to Tableau
- Otherwise, we can export just the results of the Hive query in form of JSON files to Tableau for visualization.

1) Map of restaurants across United States

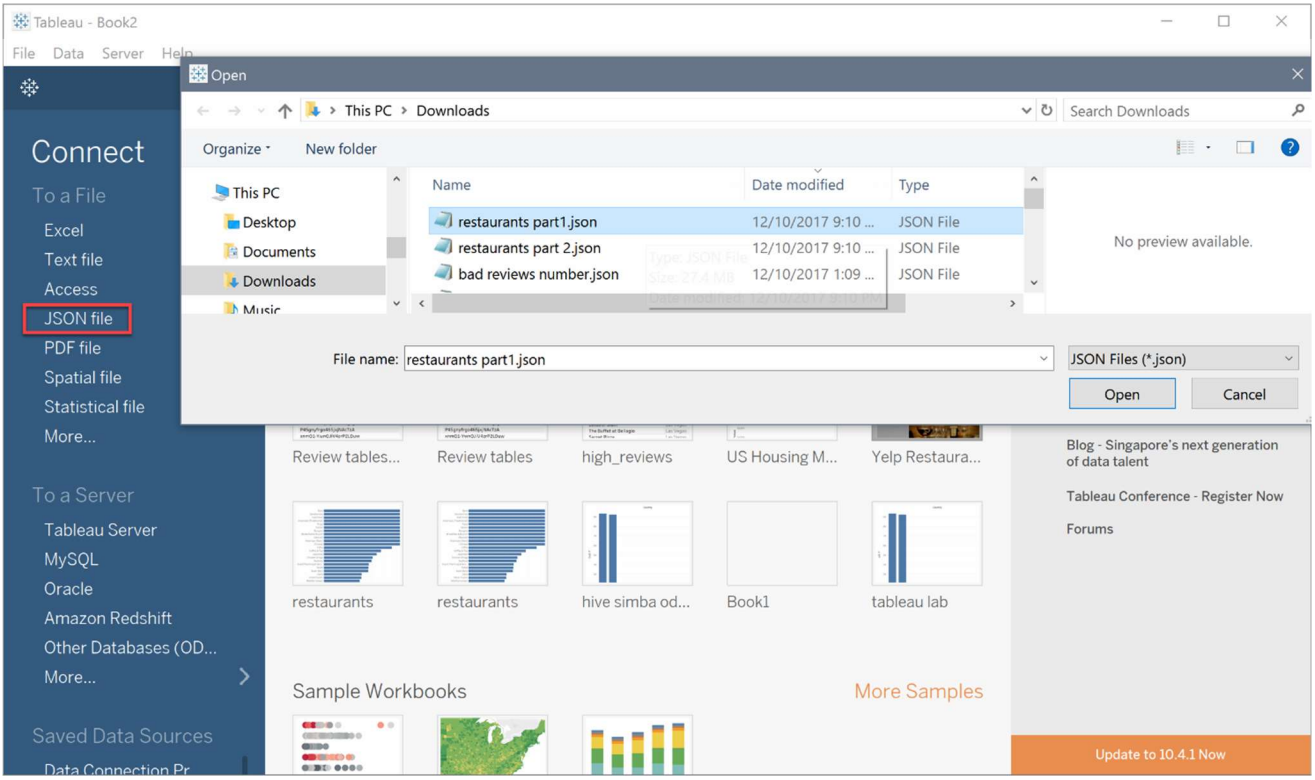
In order to visualize the results of queries in Tableau you should do the following:

a. Open Hue. Download restaurants table to your computer by downloading two files 000000_0 and 000001_0 which are located in the business/ restaurants folder in HDFS.

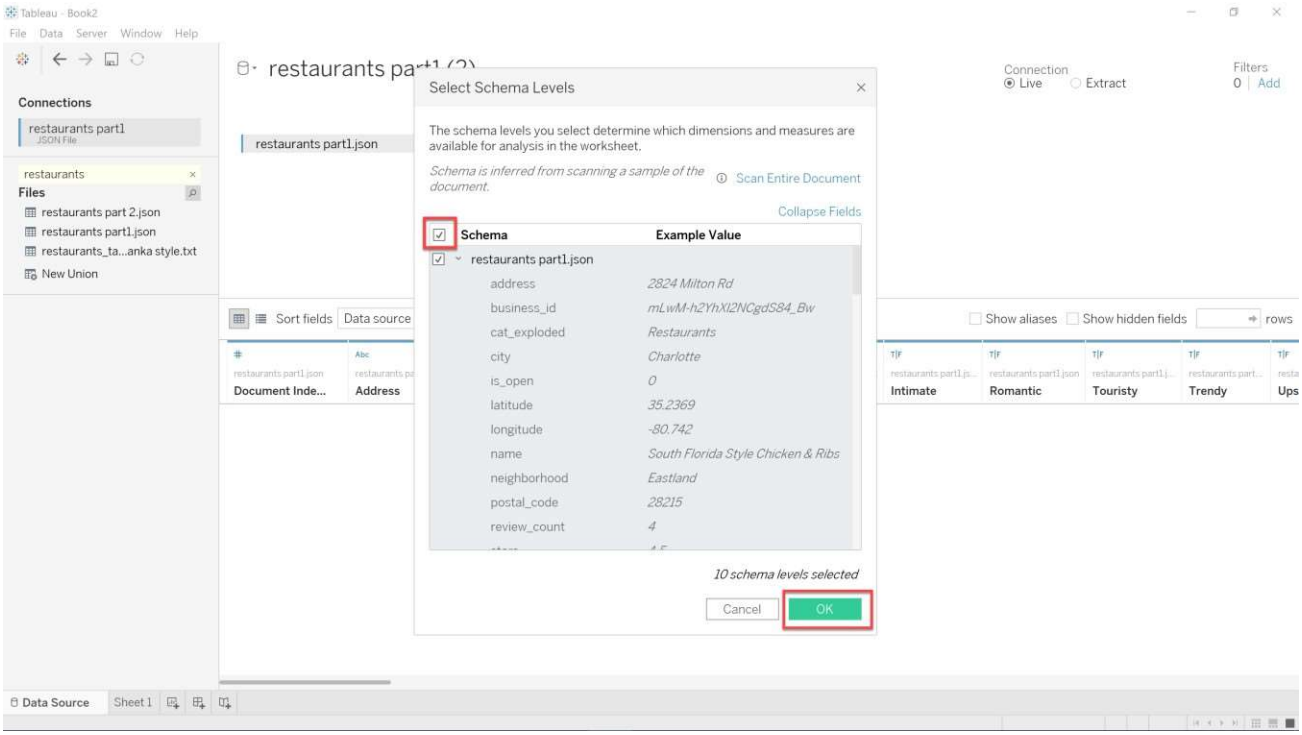
b. Click on the file, a pop-up preview window will open, then click on Download file. Repeat for the second file.

c. For ease of use, you can rename the files as restaurants part1.json and restaurants part2.json

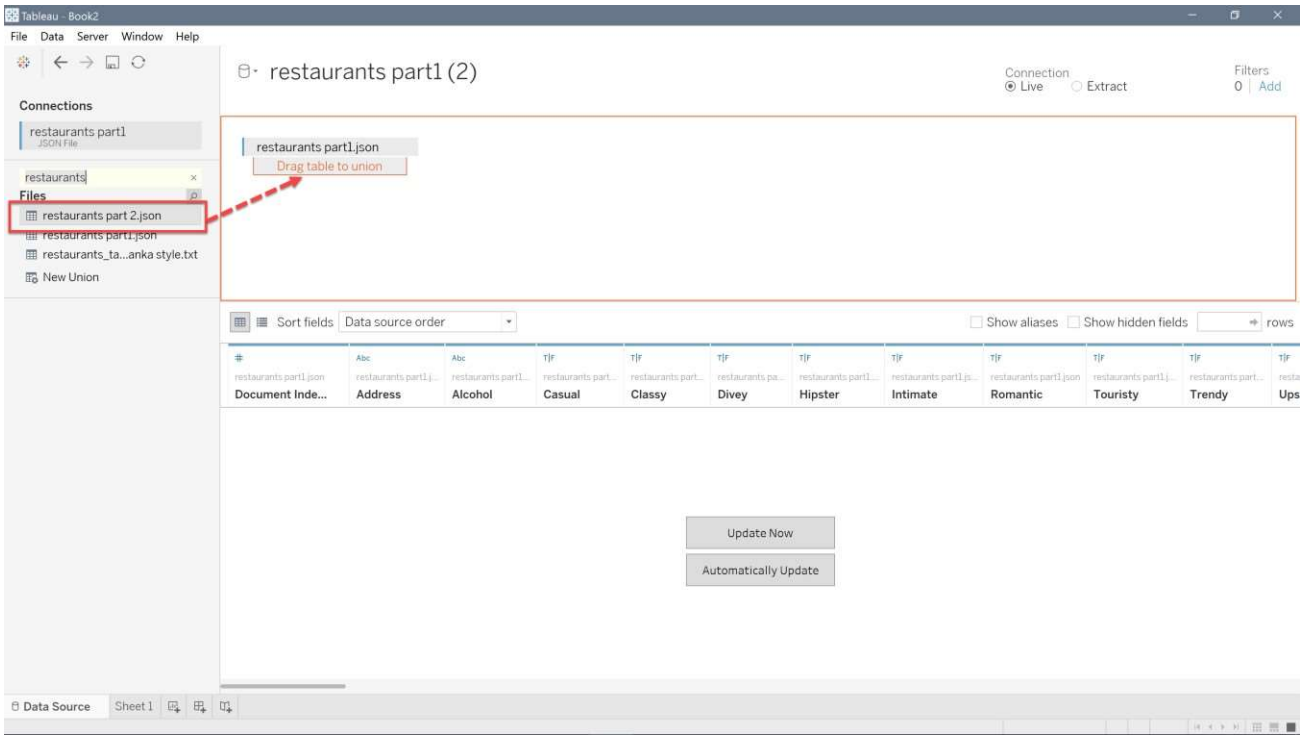
d. Open Tableau and connect JSON file as following:



e. Open the first file and select the Schema check mark as shown below.



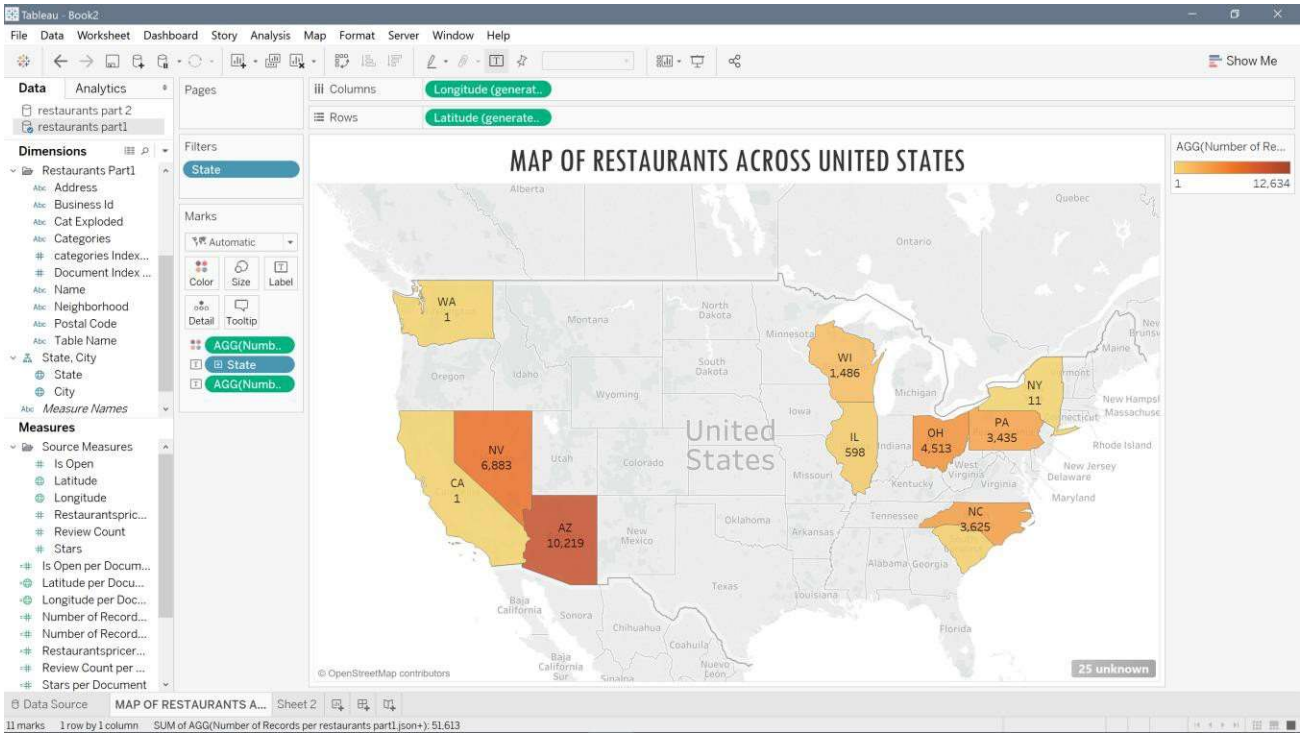
f. Since we have 2 files, we need to join them in Tableau as following:



g. To create the map visualization follow these instructions.

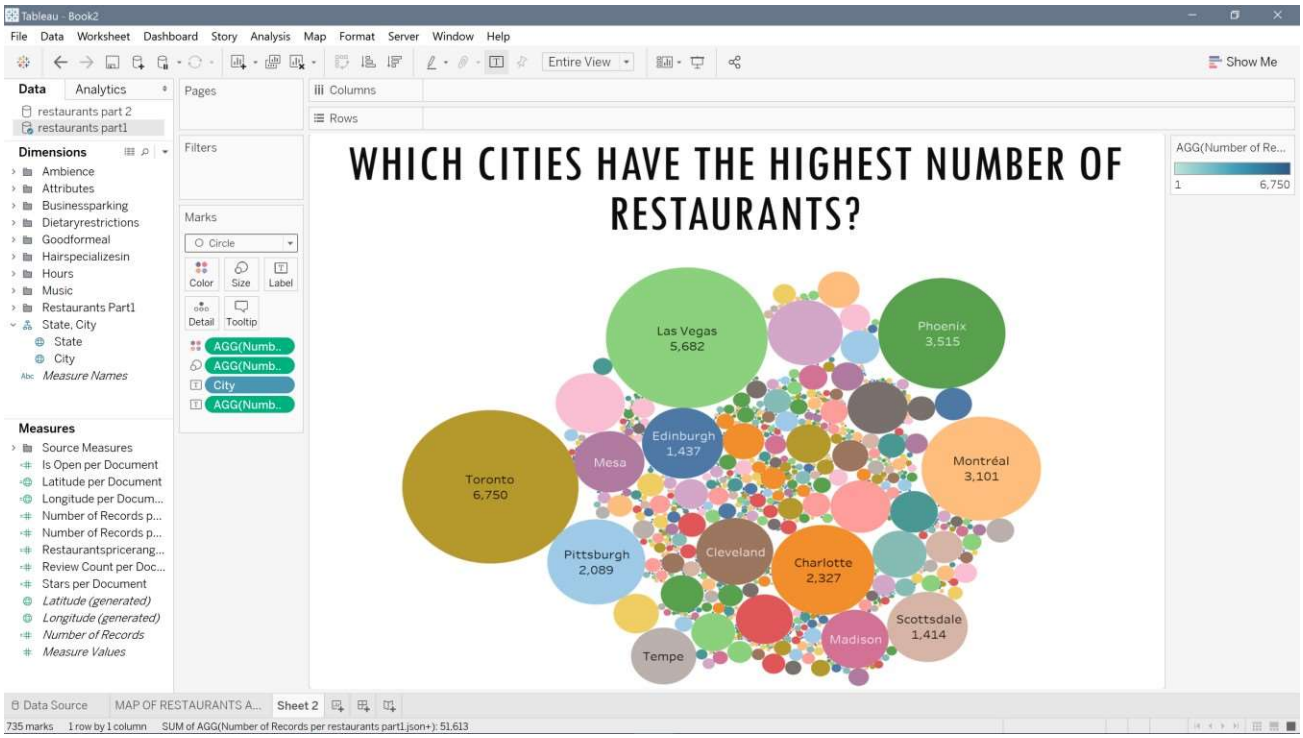
Click on Sheet 1, drag longtitude to columns, latitude to rows, number of records to color on Marks, number of records to label on Marks, state to label on Marks.

Click on color on the marks to adjust the colors to your choice. Click on title to change the title of the visualization. Your tableau worksheet should look like the image below:

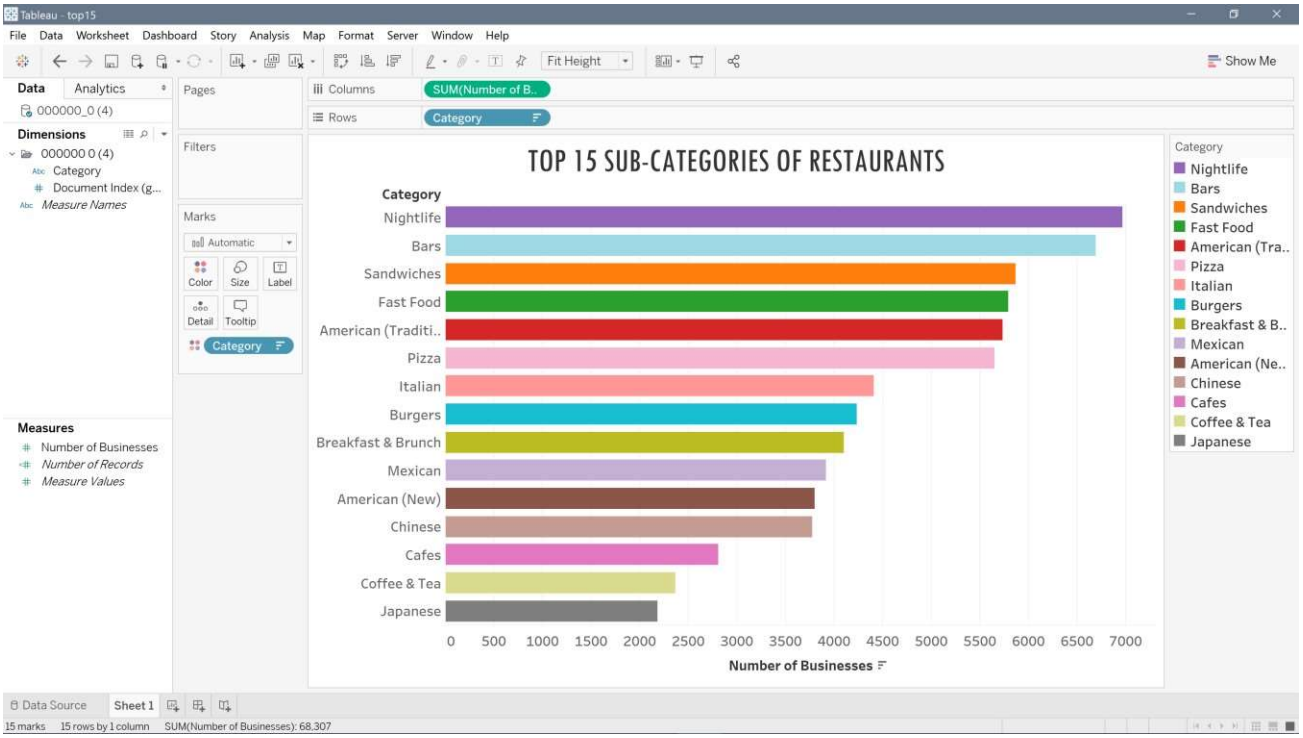


h You can follow procedures described above to produce the rest of the visualizations in this tutorial.

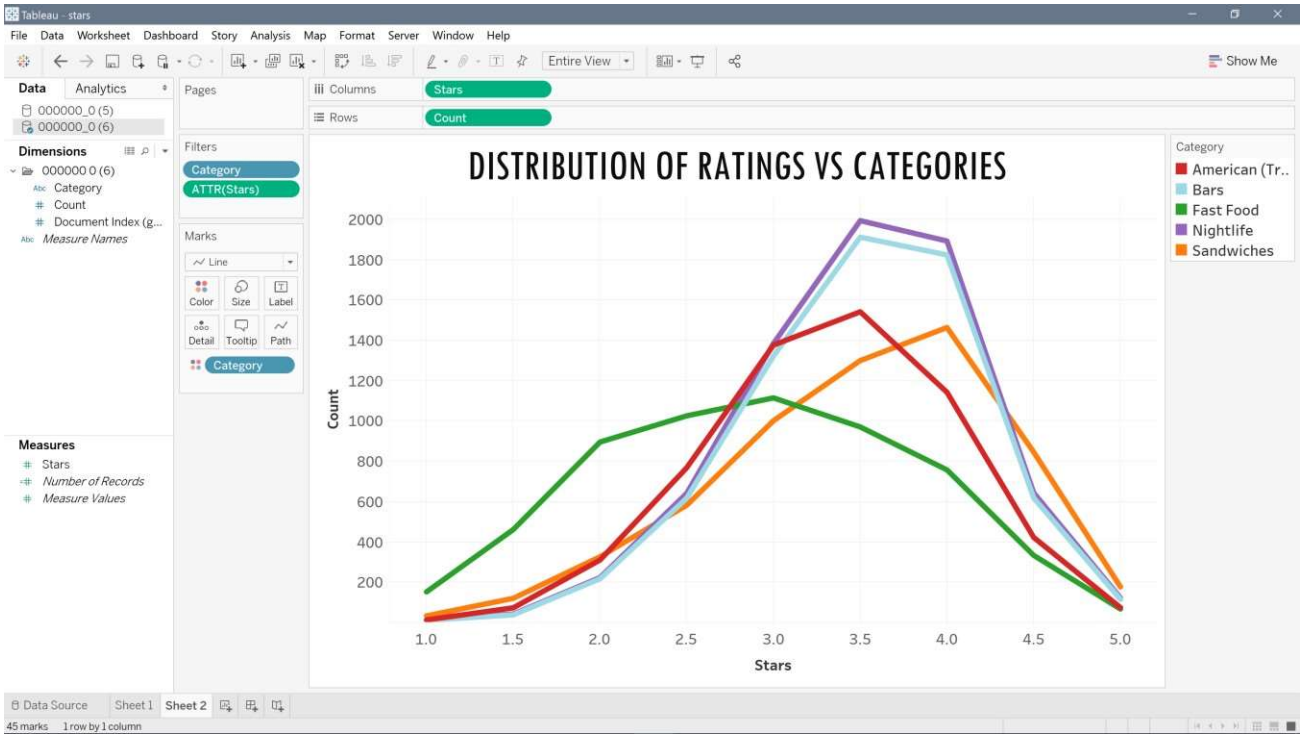
2) Which Cities Have The Highest Number Of Restaurants?



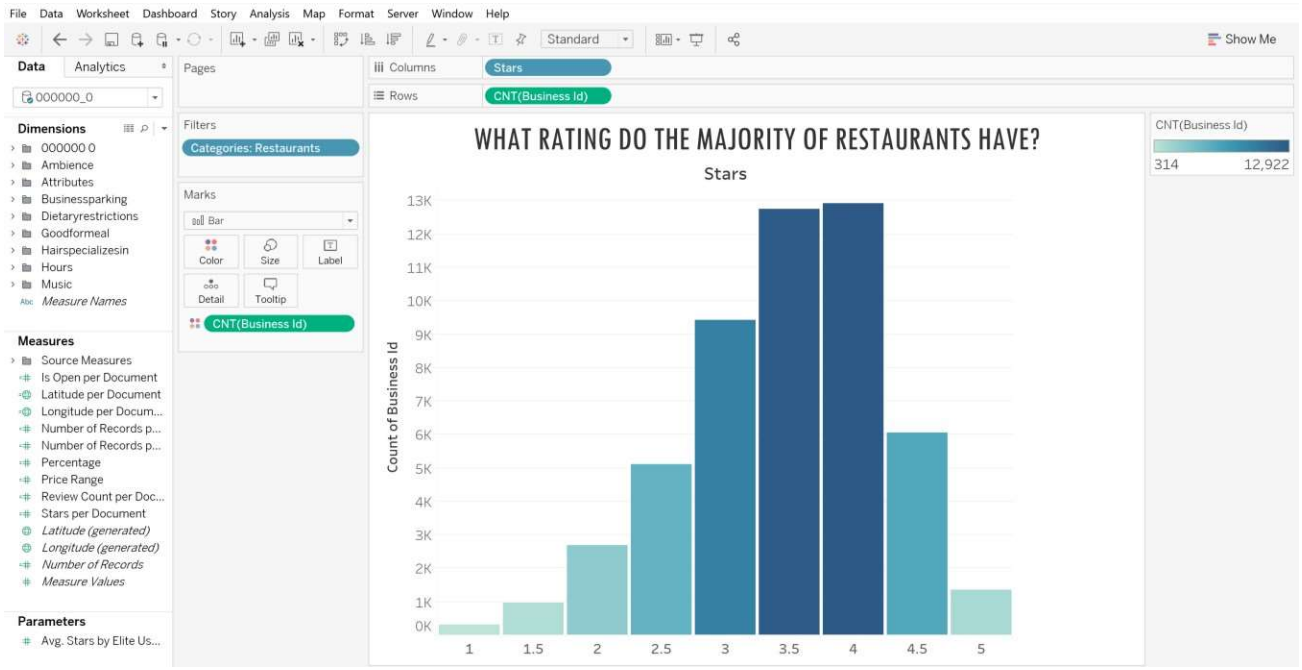
3) Top 15 Sub-Categories Of Restaurants



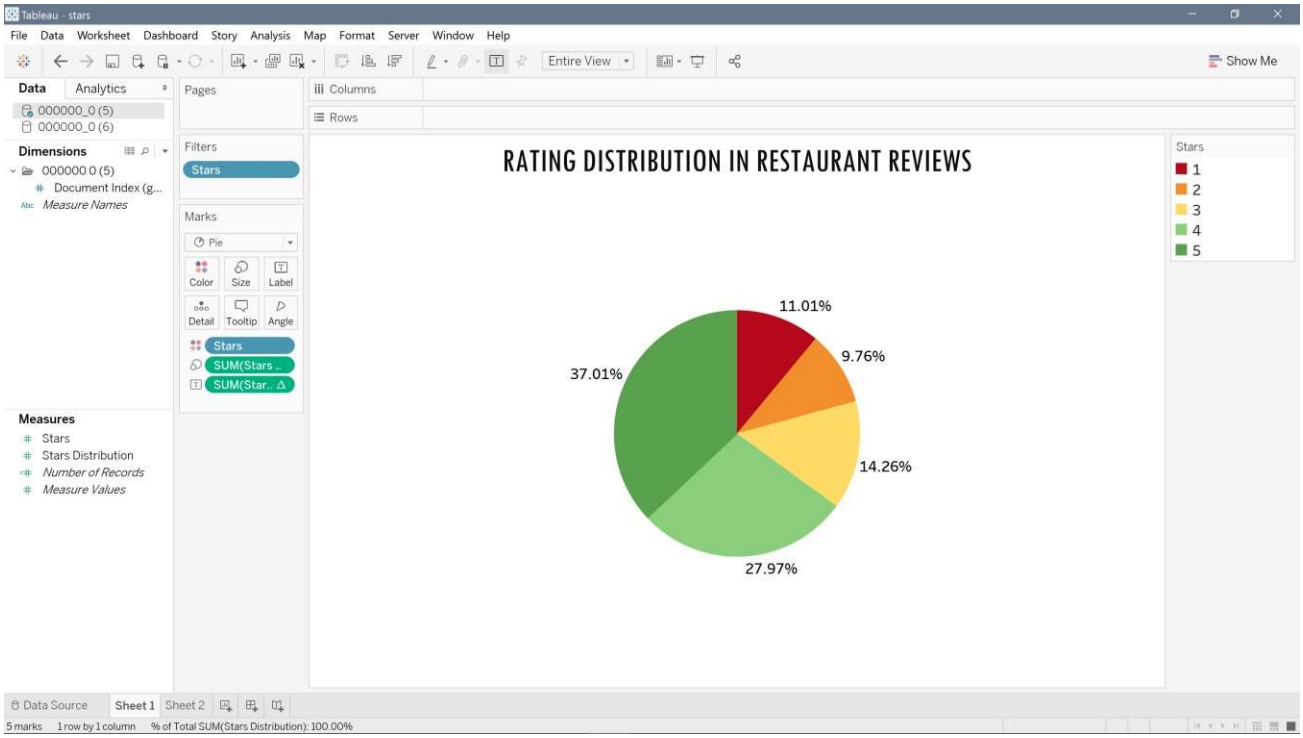
4) Distribution of ratings vs categories



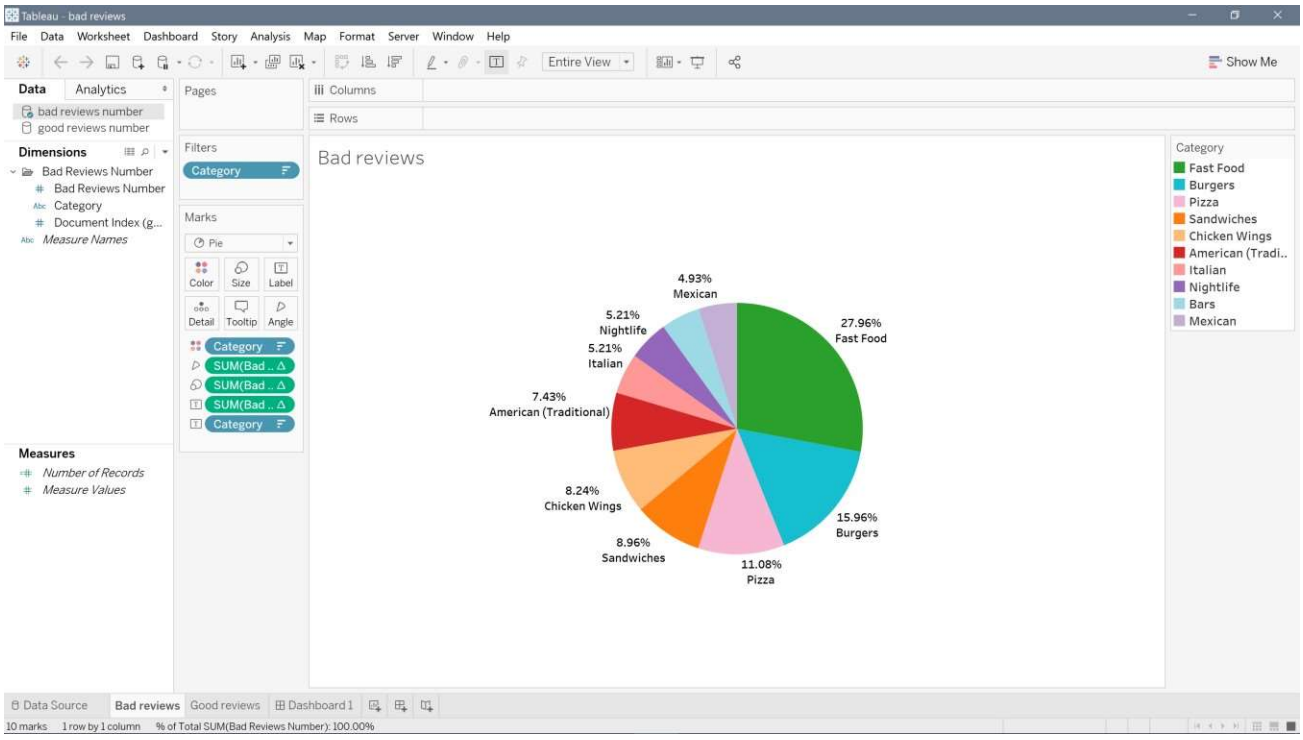
5) What ratings do the majority of restaurants have?

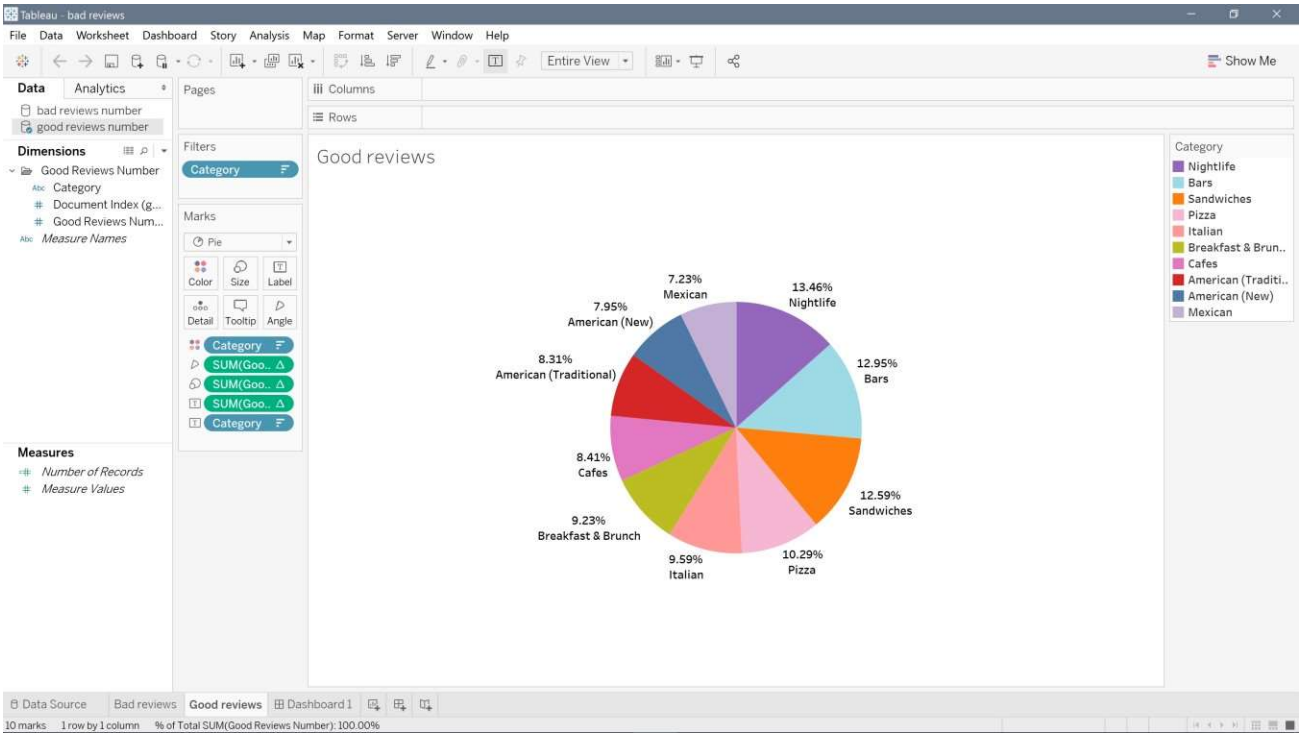


6) Rating distribution in restaurant reviews

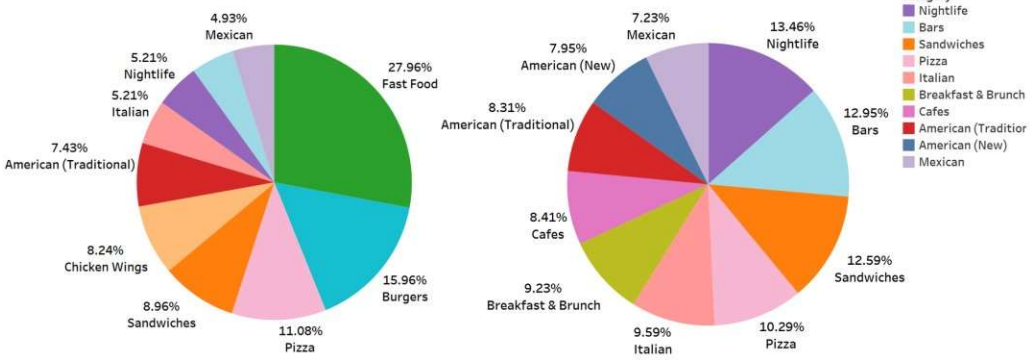


7) Which restaurants get bad vs good reviews?





WHICH RESTAURANTS GET BAD VS GOOD REVIEWS?

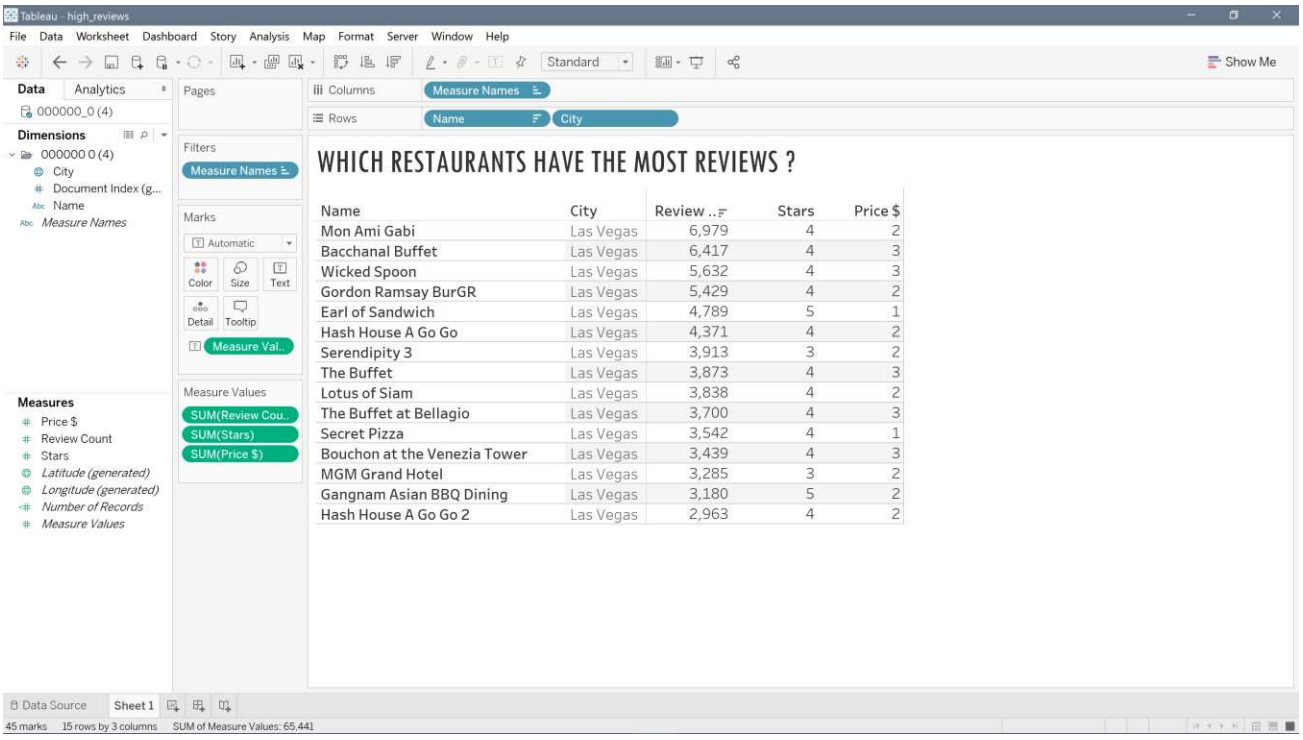


Bad reviews (1-2 stars)

Good reviews (4-5 stars)

yelp

8) Which restaurants have the most reviews?



9) What number of yelp users are elite?
Do they rate differently than non -elite users