Travel Destination Clustering

Improving Site Booking Rates with a travel recommendation engine

Hotel and travel sites have a need to encourage users to book travel destinations

- With so many site options consumers are spending much more time switching between sites to research possible travel plans, in many cases taking weeks prior to booking their destination.
- Individuals may not know specifically where they want to travel next, only that they wish to take another vacation.
- Individuals may want to visit a new location but the location they desire is over their budget.
- Users experiencing Barriers to Destination Decisions are leaving SITES without booking.

THE PROBLEM

Data Sources

Destination Options

"Savannah Historic District,Savannah,Georgia"
"Downtown Charleston,Charleston,South Carolina"
"Southwest Orlando,Orlando,Florida"
"Garden District,New Orleans,Louisiana"
"Fisherman's Wharf,San Francisco,California"
"Beacon Hill,Boston,Massachusetts"
"Bell Rock,Sedona,Arizona"
"Downtown,Key West,Florida"
"The Loop,Chicago,Illinois"
"Downtown,Houston,Texas"
"Downtown,Nashville,Tennessee"
"Union Station,Denver,Colorado"
"Downtown,Asheville,North Carolina"
"Downtown,St. Augustine,Florida"

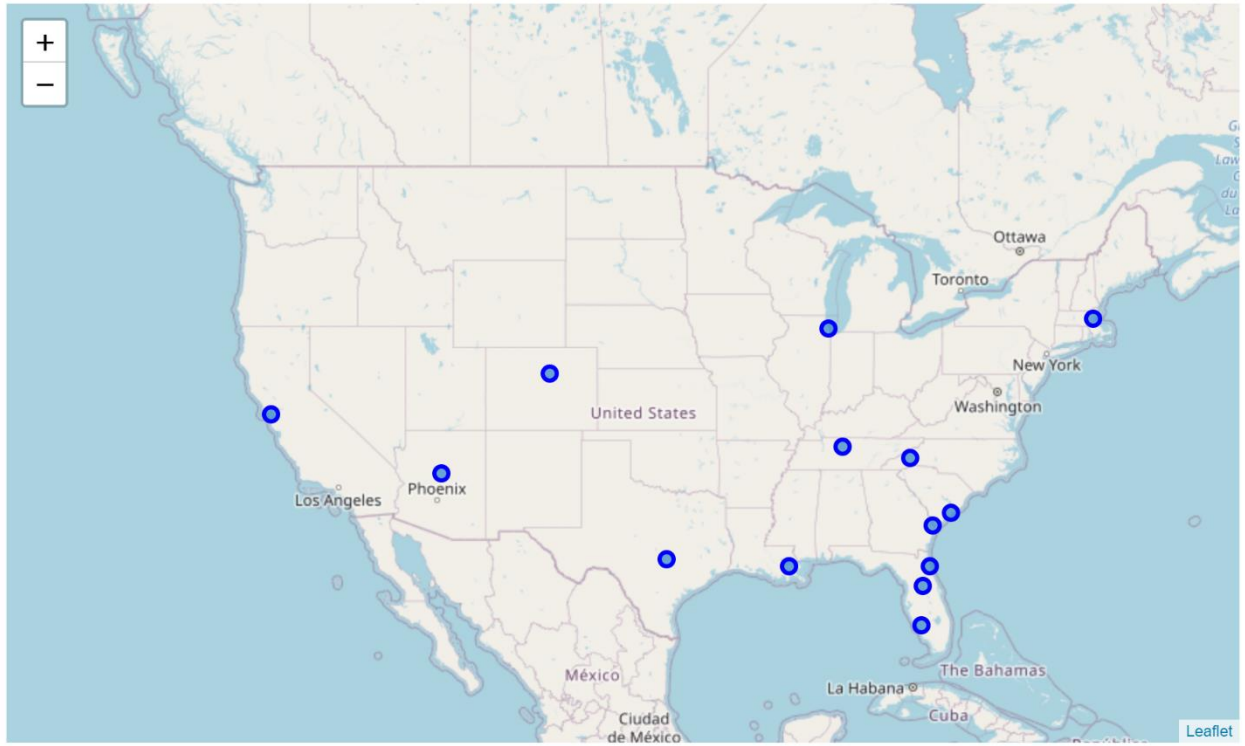
Destination Coordinates

	State	City	Latitude	Longitude
0	Arizona	Sedona	34.831453	-111.775264
1	California	San Francisco	37.809167	-122.416599
2	Colorado	Denver	39.753630	-105.000748
3	Florida	Orlando	28.876887	-81.695584
4	Florida	Key West	26.642532	-81.862867
5	Florida	St. Augustine	29.904286	-81.319455
6	Georgia	Savannah	32.072732	-81.093158
7	Illinois	Chicago	41.881609	-87.629457
8	Louisiana	New Orleans	29.929605	-90.084388
9	Massachusetts	Boston	42.358708	-71.067829
10	North Carolina	Asheville	35.593791	-82.556748
11	South Carolina	Charleston	32.777847	-79.965938
12	Tennessee	Nashville	36.163366	-86.783091
13	Texas	Houston	30.265002	-97.739304

Foursquare API

1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Memorial Site	Massage Studio	Trail	Yoga Studio	Donut Shop
ce Cream Shop	Tour Provider	Historic Site	Seafood Restaurant	Bike Rental / Bike Share
Hotel	Coffee Shop	Restaurant	American Restaurant	Mexican Restaurant
erforming rts Venue	Italian Restaurant	Dive Bar	Food Truck	Food Court
Theater	American Restaurant	Convenience Store	Brewery	History Museum
Historic Site	Hotel	Pizza Place	History Museum	Intersection
Plaza	Bed & Breakfast	Bookstore	American Restaurant	Museum
Coffee Shop	Theater	Hotel	Bakery	Middle Eastern Restaurant
Public Art	Furniture / Home Store	Historic Site	Coffee Shop	Breakfast Spot
zza Place	Italian Restaurant	Hotel	French Restaurant	Hotel Bar
Hotel	Brewery	Wine Bar	Bar	Coffee Shop
Hotel	Boat or Ferry	Harbor / Marina	Hotel Bar	Tourist Information Center
Hotel	Coffee Shop	Steakhouse	Cocktail Bar	Mexican Restaurant
Bar	Hotel	Nightclub	Cocktail Bar	American Restaurant

Visualizing Destinations



Possible destination cities are dispersed across the United States.

The destinations list was a sample set of available areas for processing of machine learning logic and conceptual implementation of a recommendation engine.

Location Venues

- Venue data was collected from the Foursquare API
- Venues were limited to 100 entries in the response from the API.
- Data was gathered from an 8,000 meter radius around each location based on latitude and longitude coordinates.
- Two cities returned the maximum number of venues (Chicago and Houston).
- 593 Venues were returned in total across all locations.

City	Venue
Asheville	40
Boston	37
Charleston	15
Chicago	100
Denver	71
Houston	100
Key West	7
Nashville	53
New Orleans	42
Orlando	2
San Francisco	45
Savannah	47
Sedona	3
St. Augustine	31

Clustering Destination Cities

State	City	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
Arizona	Sedona	0	Memorial Site	Massage Studio	Trail	Yoga Studio	Donut Shop	Food Court	Food & Drink Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant
California	San Francisco	5	Ice Cream Shop	Tour Provider	Historic Site	Seafood Restaurant	Bike Rental / Bike Share	Gym / Fitness Center	Food Truck	Pharmacy	Hotel	Pizza Place
Colorado	Denver	6	Hotel	Coffee Shop	Restaurant	American Restaurant	Mexican Restaurant	Cocktail Bar	Pizza Place	Sushi Restaurant	Gym	New American Restaurant
Florida	Orlando	2	Performing Arts Venue	Italian Restaurant	Dive Bar	Food Truck	Food Court	Food & Drink Shop	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Exhibit
Florida	Key West	3	Theater	American Restaurant	Convenience Store	Brewery	History Museum	Science Museum	Tea Room	Dive Bar	Fast Food Restaurant	Farmers Market
Florida	St. Augustine	5	Historic Site	Hotel	Pizza Place	History Museum	Intersection	Fast Food Restaurant	Breakfast Spot	Boutique	Museum	Fried Chicken Joint
Georgia	Savannah	8	Plaza	Bed & Breakfast	Bookstore	American Restaurant	Museum	Bistro	Coffee Shop	Playground	Pizza Place	Breakfast Spot
Illinois	Chicago	6	Coffee Shop	Theater	Hotel	Bakery	Middle Eastern Restaurant	Snack Place	Shoe Store	Concert Hall	Museum	Sandwich Place
Louisiana	New Orleans	7	Public Art	Furniture / Home Store	Historic Site	Coffee Shop	Breakfast Spot	Accessories Store	Neighborhood	Bookstore	Burrito Place	Bus Stop
Massachusetts	Boston	6	Pizza Place	Italian Restaurant	Hotel	French Restaurant	Hotel Bar	Plaza	Park	Outdoor Sculpture	Other Repair Shop	Optical Shop
North Carolina	Asheville	1	Hotel	Brewery	Wine Bar	Bar	Coffee Shop	Dessert Shop	Cocktail Bar	Spa	French Restaurant	Chocolate Shop
South Carolina	Charleston	4	Hotel	Boat or Ferry	Harbor / Marina	Hotel Bar	Tourist Information Center	Breakfast Spot	Boat Rental	Bar	Kitchen Supply Store	Sporting Goods Shop
Tennessee	Nashville	1	Hotel	Coffee Shop	Steakhouse	Cocktail Bar	Mexican Restaurant	Sushi Restaurant	Concert Hall	Music Venue	Bar	Library
Texas	Houston	1	Bar	Hotel	Nightclub	Cocktail Bar	American Restaurant	Burger Joint	New American Restaurant	Juice Bar	Grocery Store	Steakhouse

- 180 Unique venue categories were identified in the dataset
- A K-Means Algorithm was implemented to cluster the destination cities by most common venue categories.
- A K value of 9 was used to render 9 clusters from the original Destination City list.
- Cluster labels and top venue category associations where merged into the data set.

Visualizing Destination City Clusters

- Clusters can be visualized based on the color indicators superimposed on the original destination city map.
- Clear associations exist between such Cities as (Boston, Chicago, and Denver) and separately between (San Francisco and St. Augustine).
- More unique cities exist such as Savannah which do not cluster with other cities in the list due to their unique list of venues.

Expanding Scope

- The study performed in this project was created based on a subset sample list of possible destination cities that I determined for a vacation.
- In a more robust application this methodology can be extrapolated to cover a much larger scope of available destinations to provide even more clusters and more options within each.
- By using a K-means algorithm to provide results for this functionality and solve the problems presented, it is expected that performance in matching similar cities by using common venues from locations data would improve with a larger dataset of available locations.
- In addition to using venue categories for assessment, other variables may be included in the algorithm in a similar fashion to cluster similar destination cities. A process could also be implemented to establish a user selected variable that is most important to them in order to compare locations beyond just similarities in overall venues at a location such as narrowing venue scope to only restaurants or historic locations depending on an individual's travel interests.

Conclusion

- Based on the results of the methodology implemented on the specified dataset we can determine separate clusters for the destination city list.
- In application, these clusters allow us to implement functionalities such as a recommendation engine in a hotel or travel site.
- For a traveler who may not know where they want to visit next but knows the locations they enjoyed previously we can narrow their destination options using the results of our K-means cluster algorithm to present them with a list of cities within the same cluster as the one they have previously enjoyed. As an example from this study, a user who enjoyed visiting Chicago would be recommended to visit Boston or Denver as their next possible destination.
- In the case of the individual who may have a location in mind that exceeds their budget we can now offer recommendations for other destination options which may provide a similar experience that are more aligned with their budget. For example, if a user had interest in visiting San Francisco within our case study we can suggest to them St. Augustine.
- On a hotel or travel site these recommendations can be aligned with booking options in these specified areas allowing users to immediately assess their new options, reduce the time spent researching on multiple travel sites, and encourage more immediate travel bookings.
- By removing the barriers to the decision-making process for their next travel destination we intend to increase booking rates for sites with these implementations.