California Road Trip Simulator

Operation Optimization
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Route Optimization

- The problem we are trying to solve
- The Traveling Salesman Problem
- NetworkX library
- Base model and optimized model

Random Route Model

Random Route Example

```
calculate_random_route(cities_sample)
```

✓ 0.0s

Random Road Trip Route

	city	coords	next_city	distance_to_next	total_rolling_distance	segment_travel_time	rolling_travel_time
0	Garden Grove	(33.773906, -117.941447)	Oakley	360.0	0.0	7.09	7.09
1	Oakley	(37.997422, -121.712453)	Amador City	56.0	360.0	1.11	8.20
2	Amador City	(38.419356, -120.824103)	El Cajon	444.0	416.0	8.75	16.95
3	El Cajon	(32.794772, -116.962528)	Willits	579.0	861.0	11.41	28.36
4	Willits	(39.409608, -123.355567)	Woodlake	311.0	1440.0	6.13	34.49
5	Woodlake	(36.413561, -119.098717)	Montebello	174.0	1751.0	3.43	37.93
6	Montebello	(34.016506, -118.113753)	Blythe	205.0	1925.0	4.03	41.96
7	Blythe	(33.617233, -114.589175)	Buena Park	197.0	2130.0	3.88	45.84
8	Buena Park	(33.867514, -117.998117)	Hanford	194.0	2327.0	3.81	49.65
9	Hanford	(36.32745, -119.645683)	Garden Grove	201.0	2521.0	3.95	53.60
10	Garden Grove	(33.773906, -117.941447)	None	360.0	2721.0	7.09	60.69

```
Total Distance: 2721 miles
Estimated Travel Time: 54 hours
Runtime for Random Route: 0.01 seconds
```

Optimized Route Model

Optimized Route Example

```
calculate_optimal_route(coordinates)
```

41] ✓ 0.0s

Optimal Road Trip Route

	city	coordinates	segment_distance	rolling_distance	segment_travel_time	rolling_travel_time
0	Amador City	(38.419356, -120.824103)	0.0	0.0	0.00	0.00
1	Hanford	(36.32745, -119.645683)	158.0	158.0	3.12	3.12
2	Woodlake	(36.413561, -119.098717)	31.0	189.0	0.61	3.73
3	Montebello	(34.016506, -118.113753)	174.0	364.0	3.43	7.16
4	Buena Park	(33.867514, -117.998117)	12.0	376.0	0.24	7.40
5	Garden Grove	(33.773906, -117.941447)	7.0	383.0	0.14	7.55
6	El Cajon	(32.794772, -116.962528)	88.0	471.0	1.74	9.28
7	Blythe	(33.617233, -114.589175)	149.0	620.0	2.93	12.21
8	Willits	(39.409608, -123.355567)	630.0	1250.0	12.41	24.62
9	Oakley	(37.997422, -121.712453)	132.0	1382.0	2.60	27.22
10	Amador City	(38.419356, -120.824103)	56.0	1438.0	1.11	28.33

```
Total Distance: 1438 miles
Estimated Travel Time: 28 hours
Runtime for Optimized Route: 0.03 seconds
```

Nearest Attraction

Nearest Attraction Example

```
calculate_nearest_attractions(cities_sample)
```

✓ 0.0s

attraction city	Alcatraz Island	Balboa Park	Disneyland	Hearst Castle	Joshua Tree National Park	Legoland California	Malibu Beach	Redwoods National Park	Universal Studios Hollywood	Yosemite National Park
Amador City	96.0	443.0	357.0	189.0	420.0	415.0	325.0	79.0	326.0	79.0
Willits	120.0	576.0	490.0	284.0	566.0	549.0	452.0	232.0	457.0	230.0
Blythe	527.0	160.0	192.0	401.0	73.0	161.0	237.0	404.0	219.0	402.0
Montebello	357.0	105.0	18.0	208.0	133.0	77.0	33.0	276.0	16.0	268.0
Buena Park	369.0	92.0	6.0	220.0	126.0	65.0	41.0	288.0	28.0	280.0
Woodlake	208.0	277.0	191.0	126.0	255.0	248.0	166.0	102.0	162.0	94.0
El Cajon	464.0	12.0	89.0	312.0	101.0	31.0	131.0	378.0	123.0	371.0
Oakley	41.0	445.0	358.0	162.0	436.0	417.0	322.0	118.0	326.0	111.0
Garden Grove	376.0	85.0	3.0	226.0	123.0	58.0	46.0	295.0	34.0	287.0
Hanford	185.0	286.0	199.0	96.0	275.0	258.0	167.0	105.0	168.0	93.0

```
The closest attraction on the trip is Disneyland
It is approximately 3 miles away from Garden Grove
Runtime for Attraction Search: 0.05 seconds
```

Datasets Used

California cities dataset

https://www.kaggle.com/datasets/camnugent/california-housing-feature-engineering/data

Offenses Known to Law Enforcement by City, 2019

https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-8/table-8-state-cuts/california.xls

Chipotle Locations

https://www.kaggle.com/datasets/jeffreybraun/chipotle-locations

Feature Engineering

	city	latitude	longitude	population	vc_per_10k_ppl	vc_ranking	high_violence	cmg_stores	cmg_addresses
0	Fremont	37.548269	-121.988572	240887	16	80	0	3	2760 Mowry Ave Fremont, CA 94538; 44029 Osgood...
1	El Cajon	32.794772	-116.962528	103686	53	44	0	1	225 Jamacha Rd El Cajon, CA 92019
2	Norco	33.931125	-117.548661	26557	18	78	0	1	1409 Hamner Ave Norco, CA 92860
3	Colusa	39.214333	-122.009417	5903	10	86	0	0	N/A
4	Oakland	37.804364	-122.271114	434036	127	7	1	3	3017 Broadway Oakland, CA 94611; 3271 Lakeshor...

vc_per_10k_ppl — Violent crime rate per 10k people.

vc_ranking — City's rank in terms of violent crime.

high_violence — Is the city unusually violent?

cmg_stores — How many Chipotle locations?

cmg_addresses — Where are the Chipotle locations?

Ideas For Expansion

- Add more attractions to our current list of 10.
- Include information on various other restaurants in each city, ranging from fast-food to high-end.
- Provide the cost of overnight accommodation.
- Incorporate more detailed traffic flow data.

Links to Our Website & LinkedIn Profiles

- To view our website, go to:
  https://matthew-wright9630.github.io/RoadTrip2/
- To connect with us on LinkedIn, go to:
  www.linkedin.com/in/jordan-bintrim-544a9812b/
  www.linkedin.com/in/christopherslewicki
  www.linkedin.com/in/sawsimonlinn/
  www.linkedin.com/in/matthew-wright-a76142149/