

- RELOCATION COST TOOL
COURSERA CAPSTONE

OVERVIEW

NEED

Relocation is ever-increasing for young professionals in new roles.

Creative metrics for providing cost comparisons are sparse and often hidden in many filters



PROJECT SOLUTION

Generating a tool based on relocation needs, hidden and creative metrics can be brought to the forefront of the minds of potential relocators and they can be better informed to make a better decision depending on their own acceptance criteria



Target Audience

Young professionals facing rapid relocation for job opportunities

Data Acquisition



Cities

All cities/towns and their geolocation coordinates were scraped using pandas html read from [HERE](#)



Counties

A list of all cities and their parent counties was scraped using pandas html read from [HERE](#)



Accomodations

Median purchase and rental costs by city were scraped from [HERE](#)

- These independent tables were joined with the cities as the join conditional to ensure there were no unpopulated cities in the dataset

● SECONDARY METRICS

○ Commute Cost

What is the cost of commuting to this new job from any given area? Would that impact the user's decision? The definition of affordability changes when the picture of recurring cost is more complete

Monthly House Payment

What is a monthly payment on a mortgage when buying? 6 figures can scare anyone out of the fact that monthly payment on a \$500k single family home in Boston can be lower than \$2400, which is not far above the area rental average

● COMMUTING COST

○ Assumptions

- Car as transport
- Gas is \$3/gallon
- Distance is direct

Needs

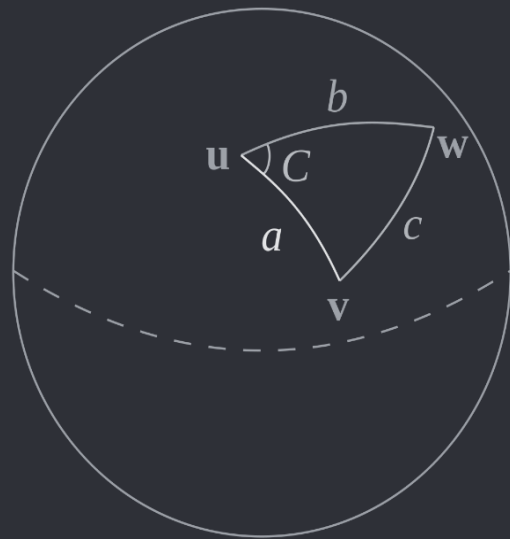
A way to calculate the distance between 2 coordinates on a globe

Solutions

The Haversine Formula! The 'great sphere distance' equation used for GPS

Haversine Formula

Using 3D trigonometry, a distance between points with curvature can be calculated with just the coordinates and some substitution of the Earth's radius! Writing a function to this end will allow a column to be calculated in the existing dataframe



```
def haversine_distance(lat1, lon1, lat2, lon2):  
    r = 6371  
    phi1 = np.radians(lat1)  
    phi2 = np.radians(lat2)  
    delta_phi = np.radians(lat2 - lat1)  
    delta_lambda = np.radians(lon2 - lon1)  
    a = np.sin(delta_phi / 2)**2 + np.cos(phi1) * np.cos(phi2) * np.sin(delta_lambda / 2)**2  
    res = r * (2 * np.arctan2(np.sqrt(a), np.sqrt(1 - a)))  
    res_mi=res*0.621371  
    return np.round(res, 2)
```

$$a = \sin^2(\phi_B - \phi_A/2) + \cos \phi_A * \cos \phi_B * \sin^2(\lambda_B - \lambda_A/2)$$

$$b = 2 * \operatorname{atan2}(\sqrt{a}, \sqrt{1-a})$$

$$c = R \cdot b \text{ (where } R \text{ is the radius of the earth)}$$

● MONTHLY HOUSE PAYMENT



Assumptions

- First time home buyer (3% down)
- 3% interest
- 30-year fixed mortgage
- Good credit!

Needs

A way to determine monthly payments for a total cost

Solutions

A simple and common interest and payment formula!

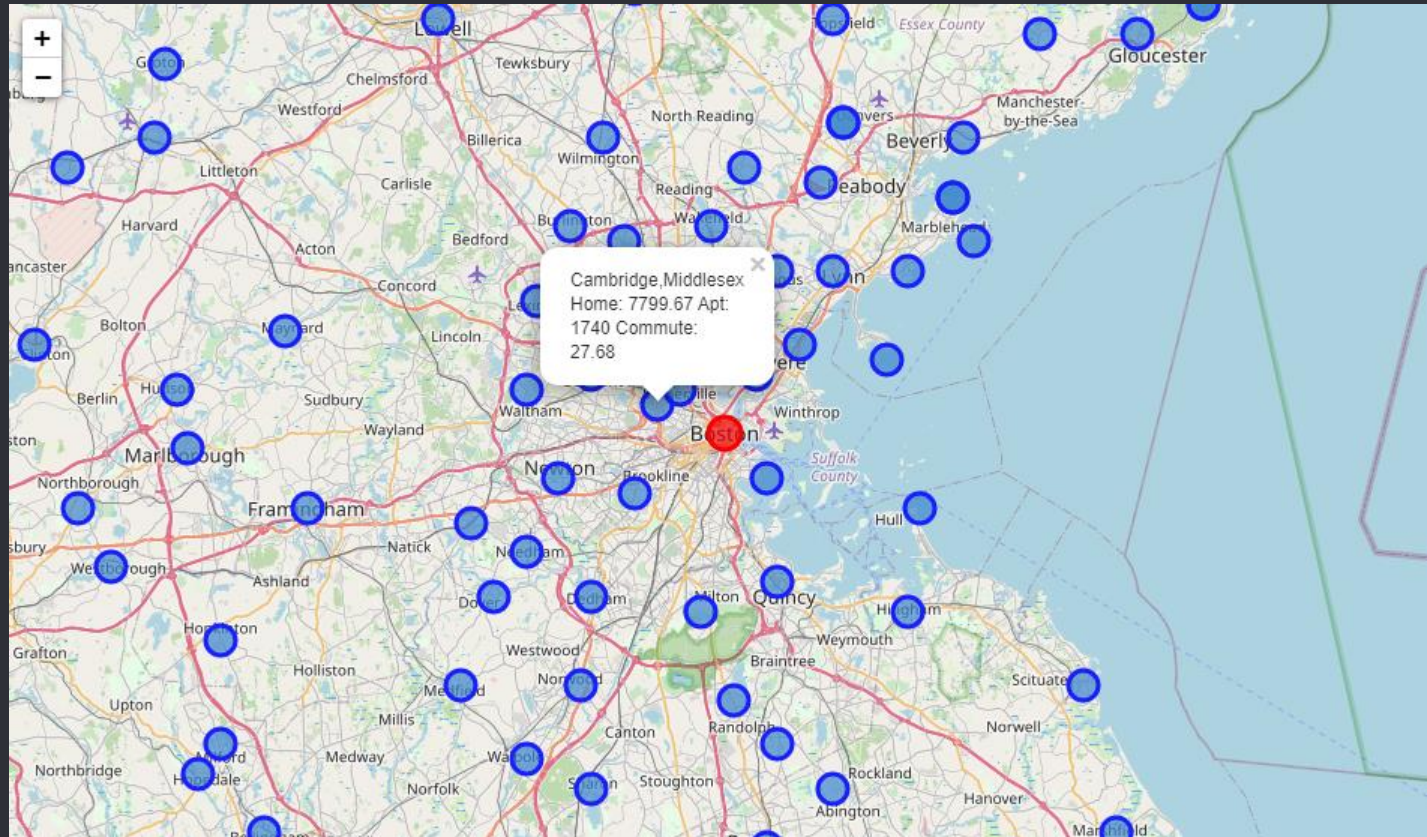
Payment Formula

Using the principal loan amount (the reported median cost) and the assumption rates and payment plans, this formula can be used to generate this critical secondary metric for the users decision

```
def mon_mortgage(P,r,n):  
    M = P*(r*(1+r)**n)/((1+r)**n-1)  
    return np.round(M,2)
```

$$M = P [I (1 + I)^N] / [(1 + I)^N - 1]$$

The Result



The Result

A map feature not unlike current accomodation listing sites but rather than specific properties, a general area monthly cost for buying, renting, and commuting. This added color and interaction allows anyone to quickly identify how far they want to live from their new job, and in what area they are comfortable with the cost of renting or buying before entering the overwhelming wordld of property sites. This reduces stress and keeps relocation an easier consideration and an easier offer from the company

Reflections

This course taught much but perhaps the one thing I learned that this tool tries to showcase, is the diversity of individual needs when it comes to data for which there is never enough machine learning to nail down. Sometimes the best thing to be done is to be creative in portraying that data to users and offering them new ways to digest contextualized information to better equip them, the consumers, to make these decisions