Plate Mate

‘The Restaurant Recommendation App’

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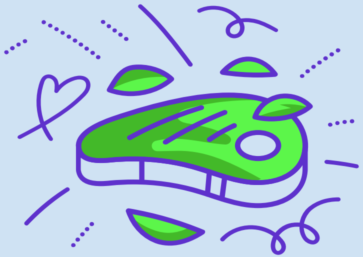
01

Vision

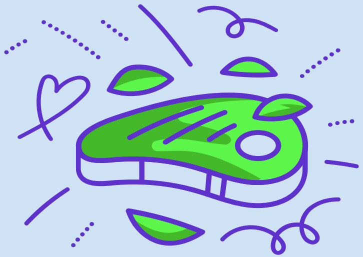
Project Goal and Approach

Are you looking for a restaurant with a group of your friends?



The Problem:

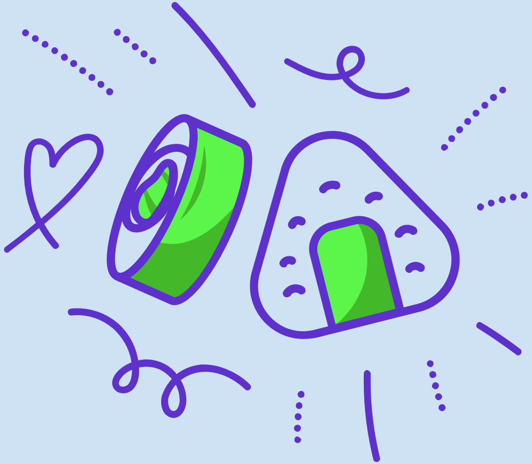
"Making dinner plans that a group of friends will all agree on is a tough task! As students, not only are dietary preferences important but travel, budgetary restrictions, and free time all must be considered when deciding on a restaurant to eat at.



Our Mission:

"Inspired by this challenge, our group has decided to build a personalized restaurant recommendation app to facilitate restaurant selection based on group preferences and help users discover new, exciting restaurants in their area!

Our Approach:



Goal: Maximize the rating of 5 local restaurants based on user preferences

1. Constrain restaurant choices based on meal, budget, and travel preferences
2. Ensure that the 5 restaurants selected are very different
3. Suggest popular items for each restaurant selected
4. Provide information to make reservations

Our Goals

Maximize the sum of the "ratings" of each team member

Meet Personalized requirements

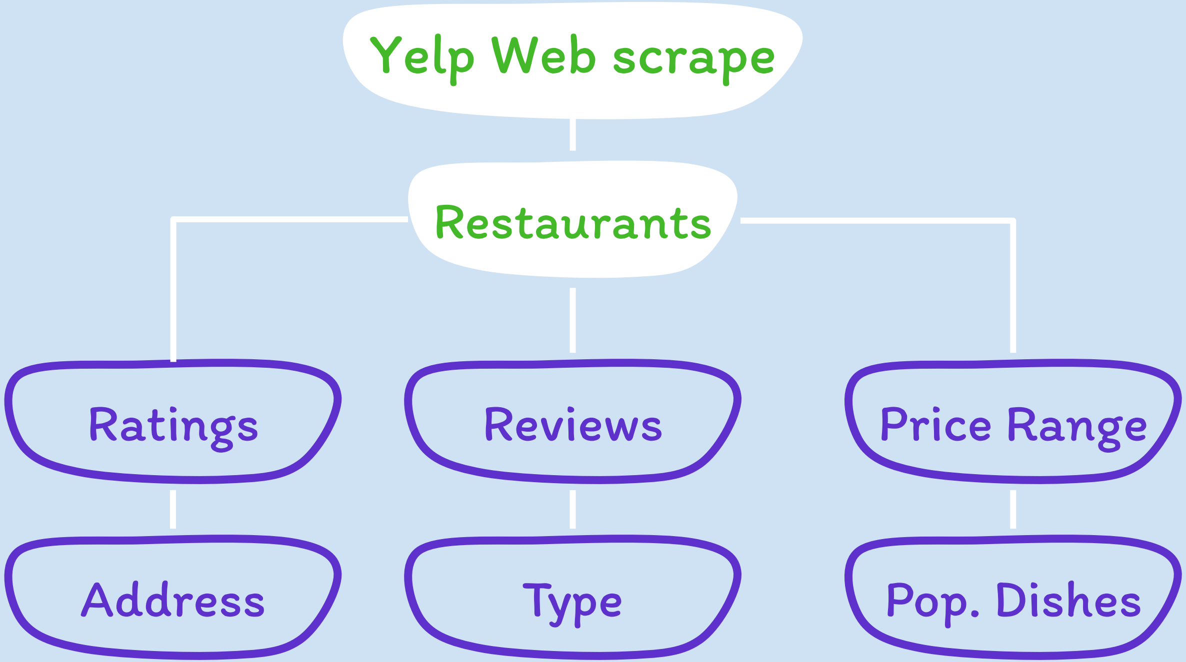
Provide relevant information or recommendations

Close to user's taste

02

Technical Approach

Step 1: Web Scrape Yelp Data



- Scrape Yelp to construct database of restaurants in LA area
- Pull specified features from Yelp
- Additional features may be used for prototype

Extensions of Scraping

Activities

Help users to explore activities near restaurants.
Like gym, bar, indoor rock climbing

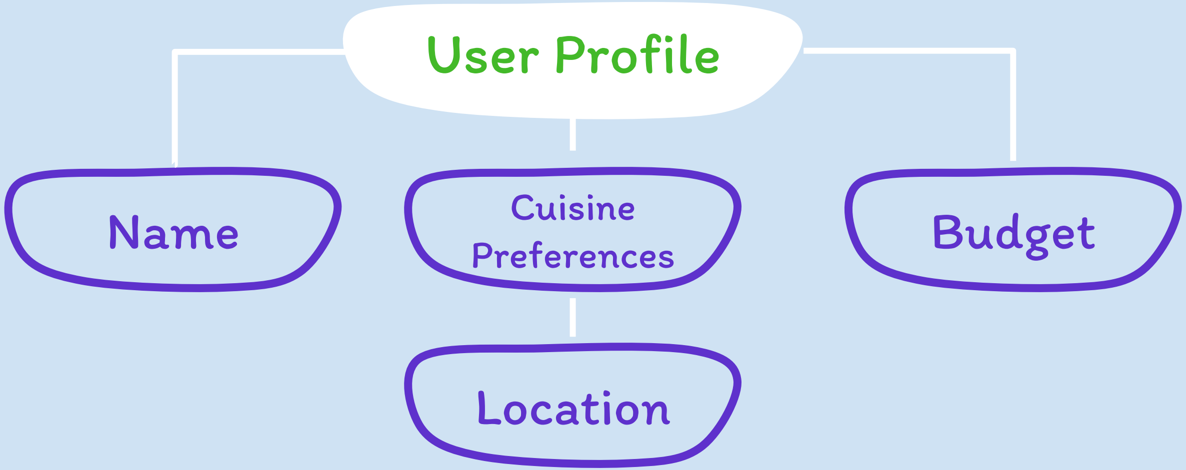
Additional information

Delivery
Limited capacity
Parking
Updated Services

Price Range

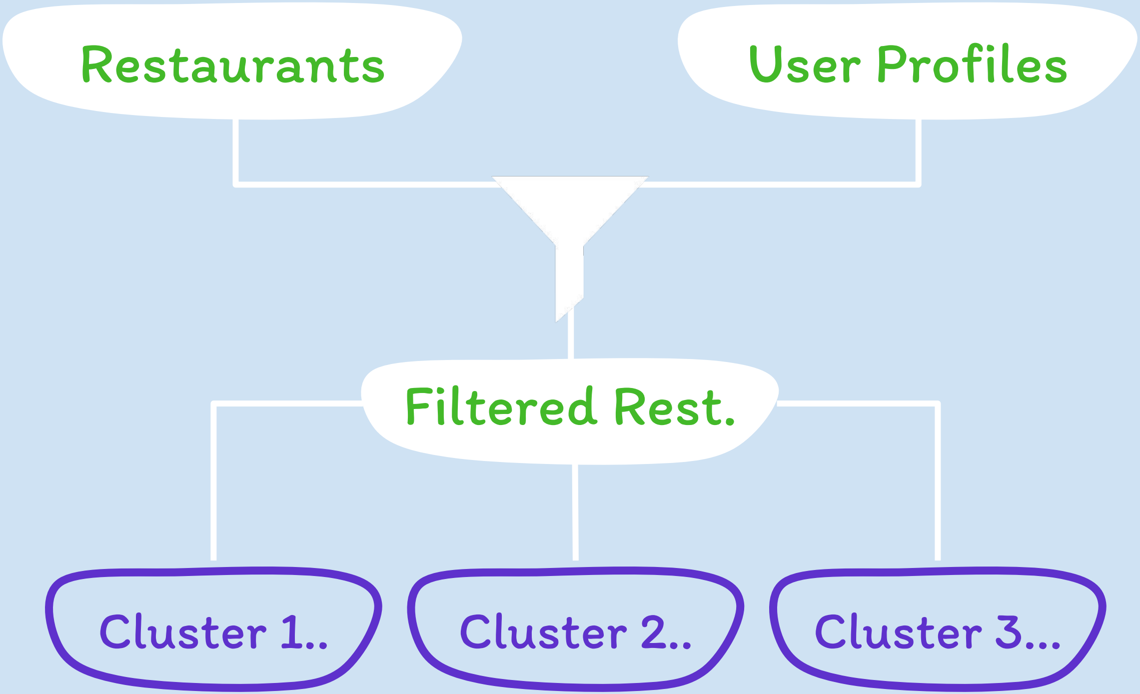
Convert the $ to specific price range based on the online information

Step 2: Build User Profiles



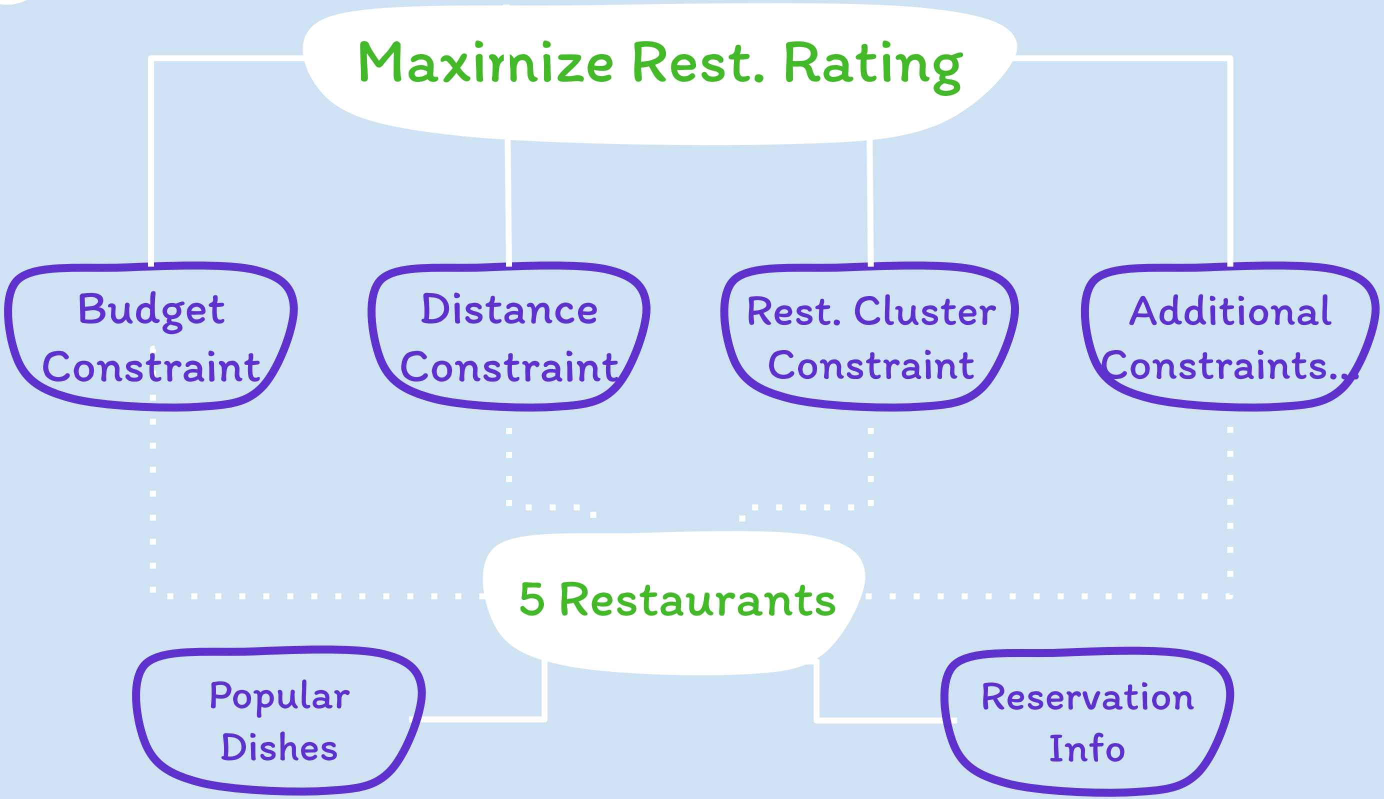
- Take User inputs to build profile
- Define specified parameters to be used in optimization and filtering

Step 3: Filter Data and Cluster



- Use User Profile "Cuisine Preferences" & Locations to pre-filter restaurants dataset
- Use K-Means Clustering to define specific clusters for filtered restaurants

Step 4: Run Optimization Function



Setup

Let $k \in K$ index the users whose preference is to be accounted for.

Let $m \in M$ index the month we will be requesting a restaurant recommendation for.

Let $n \in N$ index the total number of restaurants in Los Angeles available on Yelp!.

Let $\mathcal{X} = \{x_1, x_2, \cdots, x_N\}$ be a matrix that denotes our dataset of webscraped restaurant information from Yelp!, where

$$x_n = \begin{bmatrix} \text{name} = \{\textbf{String}\} \\ \text{address} = \{\textbf{String}\} \\ \text{neighbourhood} = \{\textbf{String}\} \\ \text{num\_reviews} = \{0.0 \leq \textbf{Integer} \leq \infty\} \\ \text{rating} = \{0.0 \leq \textbf{Float} \leq \textbf{5.0}\} \\ \text{price\_range} = \{\$, \$\$, \$\$\$, \$\$\$\$\} \\ \text{categories} = \{\text{Breakfast \& Brunch, Korean}, \cdots, \text{Halal}\} \end{bmatrix}$$

Let $\mathcal{U} = \{u_1, u_2, \cdots, u_K\}$ be a matrix, where

$$u_k = \begin{bmatrix} \text{address} = \{\textbf{String}\} \\ \text{neighbourhood} = \{\textbf{String}\} \\ \text{min\_reviews} = \{0.0 \leq \textbf{Integer} \leq \infty\} \\ \text{min\_rating} = \{0.0 \leq \textbf{Float} \leq \textbf{5.0}\} \\ \text{price\_range} = \{\$, \$\$, \$\$\$, \$\$\$\$\} \\ \text{max\_distance (miles)} = \{0.0 \leq \textbf{Float} \leq \infty\} \\ \text{categories} = \{\text{Breakfast \& Brunch, Korean}, \cdots, \text{Halal}\} \end{bmatrix}$$

Let $w \in \mathbb{Z}_2^N = \{0, 1\}^N$ a binary indicator vector denoting which of the N restaurants in the Los Angeles area were chosen.

Let $d : L \times L \rightarrow \mathbb{R}_0^+, L = \{\textbf{Valid Address String}\}$ be a function that calculates the distance in miles between two points.

Let A. <attribute> denote the column vector (if A is a matrix) / scalar (if A is a vector) of just the specific attribute.

Solving the Problem by MIP

$$\underset{w}{\text{maximize}}\ w^{\top}(\mathcal{X}.\,\text{rating})$$

$$\text{subject to } w^{\top}\mathbb{1} = M$$

$$w_n u_k.\,\text{min\_reviews} \leq x_n.\,\text{num\_reviews}\ \forall\, n \in N, k \in K$$

$$w_n u_k.\,\text{min\_rating} \leq x_n.\,\text{rating}\ \forall\, n \in N, k \in K$$

$$w_n \left(1 - \frac{\min_{n,k} d(x_n.\,\text{address}, u_k.\,\text{address})}{\max_{n,k} d(x_n.\,\text{address}, u_k.\,\text{address})}\right) \leq \alpha_n\ \forall\, n \in N, k \in K,$$

$$u_k.\,\text{price\_range} \geq x_n.\,\text{price\_range}\ \forall\, n \in N, k \in K,$$

$$u_k.\,\text{neighbourhood} = x_n.\,\text{neighbourhood}\ \forall\, n \in N, k \in K,$$

$$u_k.\,\text{categories} \subseteq x_n.\,\text{categories}\ \forall\, n \in N, k \in K,$$

03

Resources & Software

Software

Python

pyomo, pandas, numpy,
scikit-learn(for clustering)
cvxpy

SQL

Possible use of SQL

R

Statistical Analysis
Data mining
dplyr,
Clustering(k-means)

04

Responsibilities & Timeline

Responsibilities

Yiyi Wang

- MIP Optimization
-Data Cleaning
-Testing

Miao Xu

-MIP Optimization
- Testing

Jacob Andreesen

- Web-scraping
- Data Cleaning
- Testing

Jeff Chen

- Web-scraping
- Clustering
- Testing

Timeline

3/3
Web-Scraping

3/10
Data Cleaning

3/17
User Profile Set-up

3/24
MIP Optimization

3/31
Clustering & Visualization

Thanks
Fight on!