
Food & You

**Enhancing Restaurant Experience with
Neural Networks and Natural Language
Processing**

Camden Hunt and Na'inoa Loo

Data Collection

- Originally used Yelp API and Tomorrow.io API
 - Rate limits made progress difficult
- Was able to make API calls and get specific data we wanted

Example Data Output

```
Name: Colton's Social House, Rating: 4.2, Temperature: 24°C, Weather Code: 1001
Name: Pismo's Coastal Grill, Rating: 3.9, Temperature: 23.63°C, Weather Code: 1102
Name: Carrillo's Mexican Food, Rating: 4.4, Temperature: 24°C, Weather Code: 1001
Name: The Curry Pizza Company, Rating: 4.6, Temperature: 23.88°C, Weather Code: 1001
Name: The Mogul Restaurant Rating: 4.4, Temperature: 9.13°C, Weather Code: 1000
```

- Eventually we moved to official Yelp Dataset due to rate limits
 - Does weather matter if we are looking at a small geographic area?

Yelp Dataset

- Yelp dataset contains:
 - 6,990,280 reviews
 - 150,346 businesses
 - 200,100 pictures
 - 11 metropolitan areas
- Only looked at Santa Barbara metropolitan area
 - 211,748 reviews
 - 968 businesses

restaurants.json

For each restaurant, contains several variables we looked at, such as:

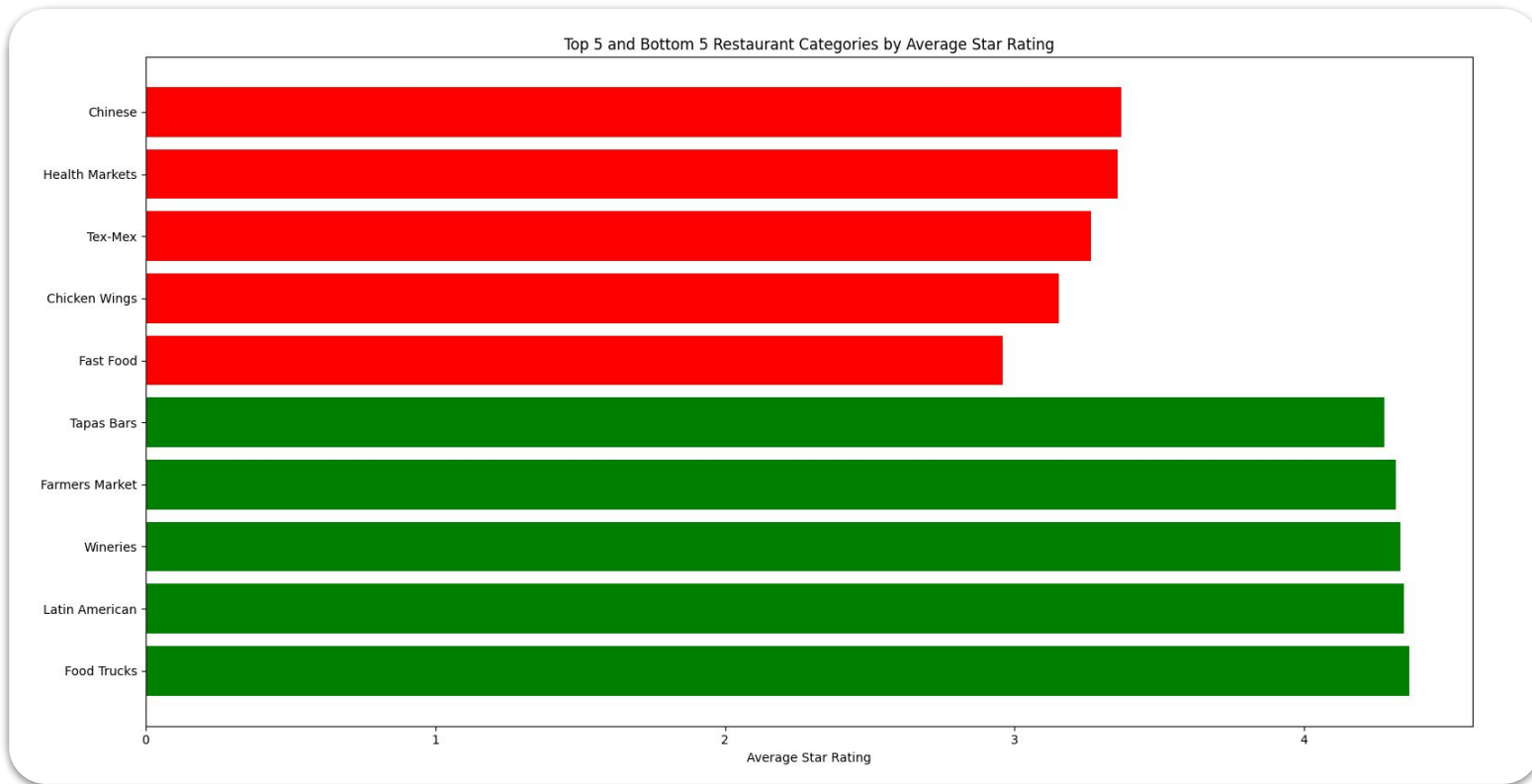
- Serve alcohol?
- BYOB?
- Bike parking?
- Accepts crypto?
- By appointment only?
- Caters?
- Coat check?
- Dogs allowed?
- Drive-thru?
- Dancing?
- Kids?
- Happy hour?
- TVs?
- Music?
- Open 24 hours a day?
- Outdoor seating?
- Delivery?
- Good for groups?
- Reservations?
- Takeout?
- Smoking allowed?
- Wheelchair accessible?

reviews.json

Contains basic data each review, such as:

- Review ID
- User ID
- Business ID
- Star rating
- Review content

reviews.json

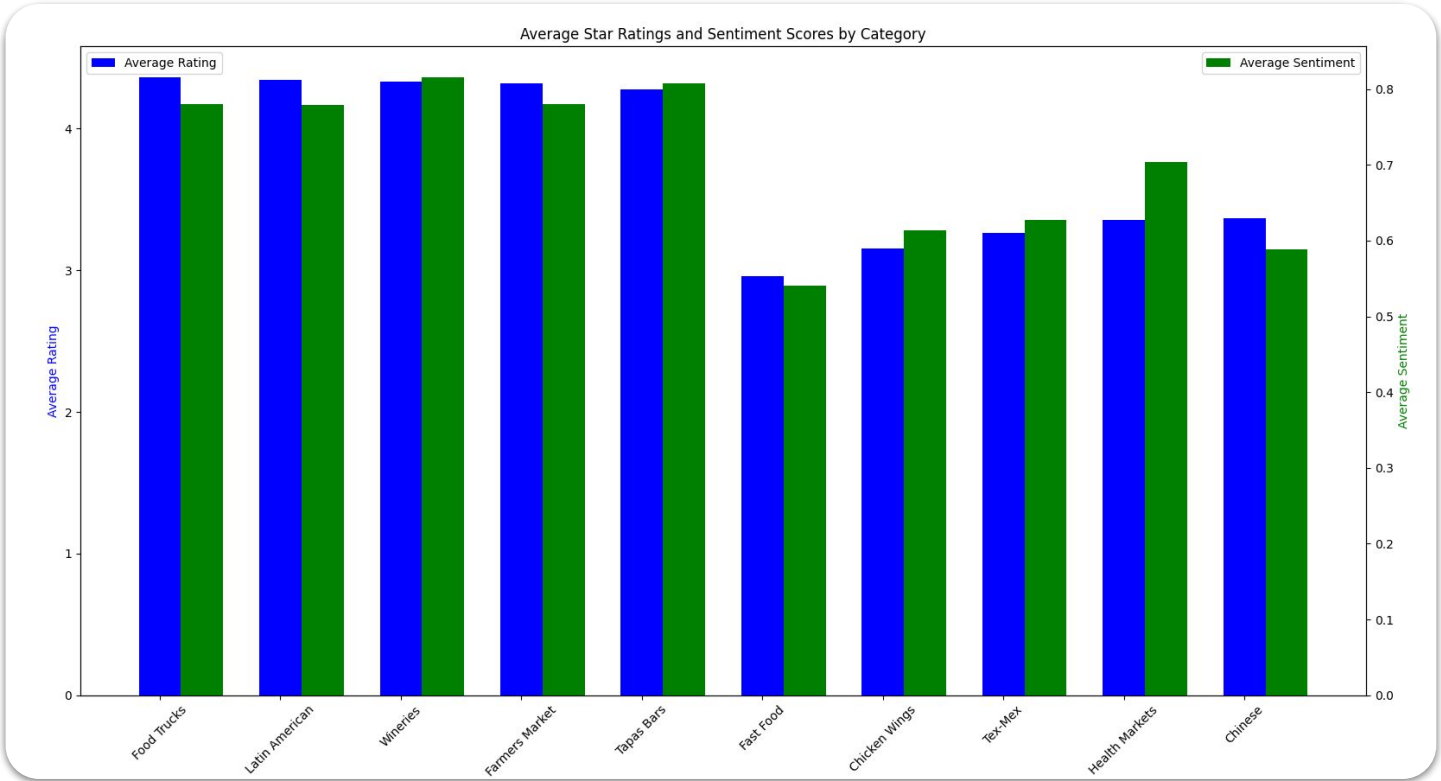


Sentiment Analysis

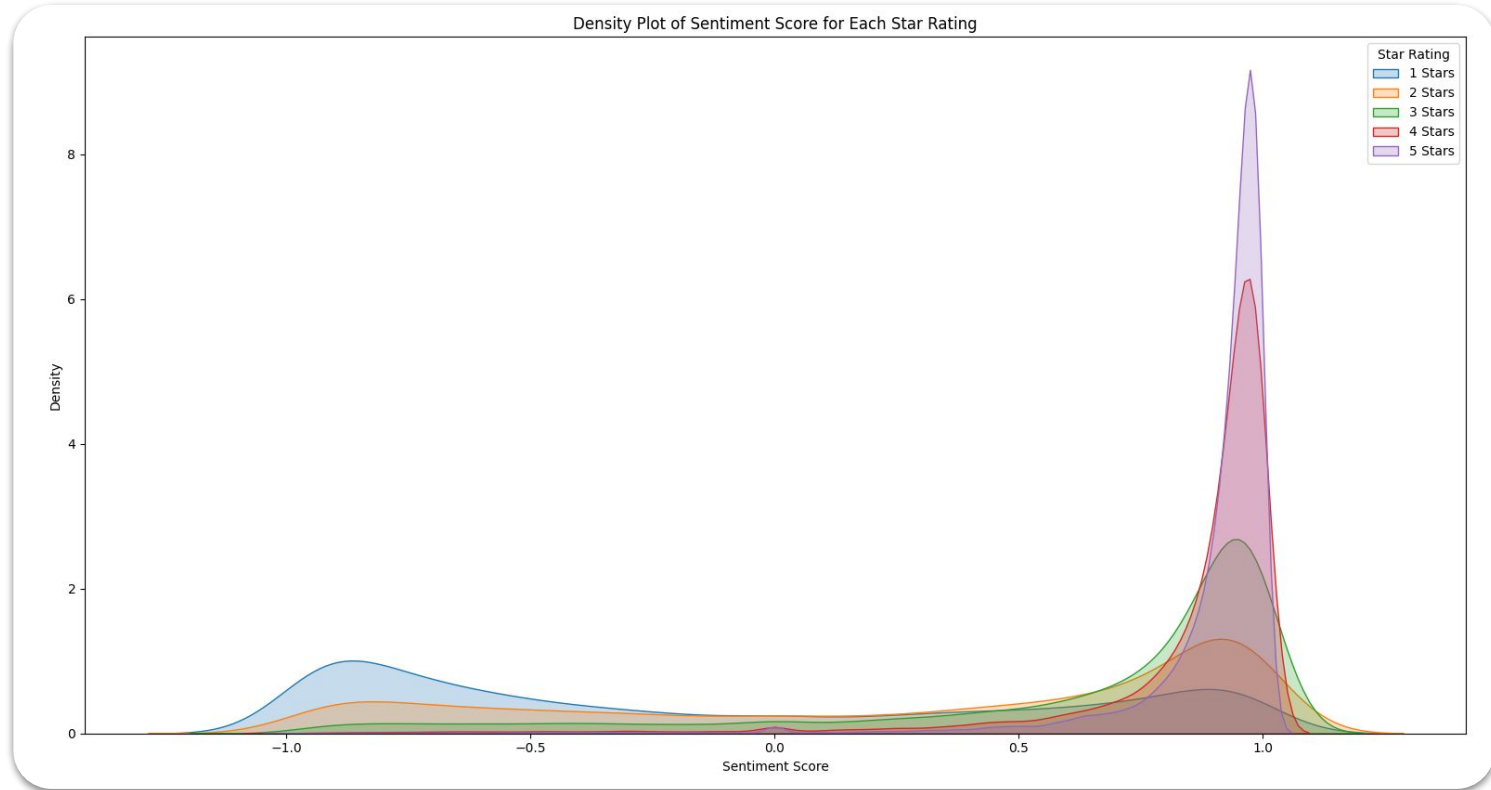
- Used sentiment analysis (using NLTK) to look at general feelings behind each review
 - Theoretically should correlate strongly with star rating



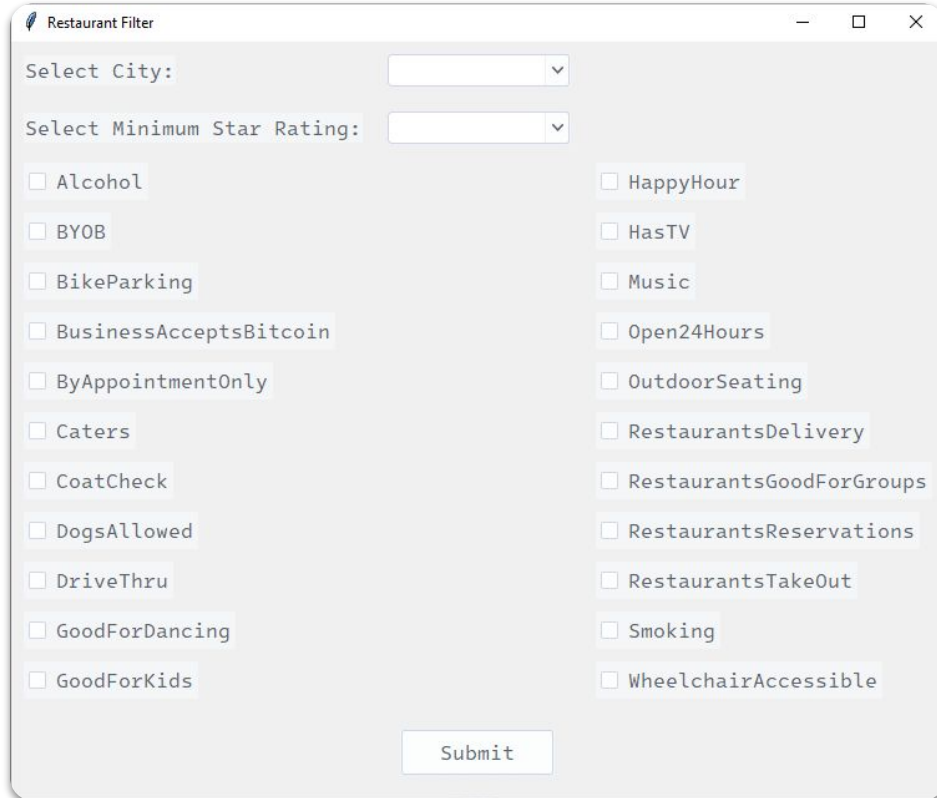
Sentiment Analysis Results



Sentiment Analysis Results



Restaurant Filter GUI



Restaurant Filter

Select City:

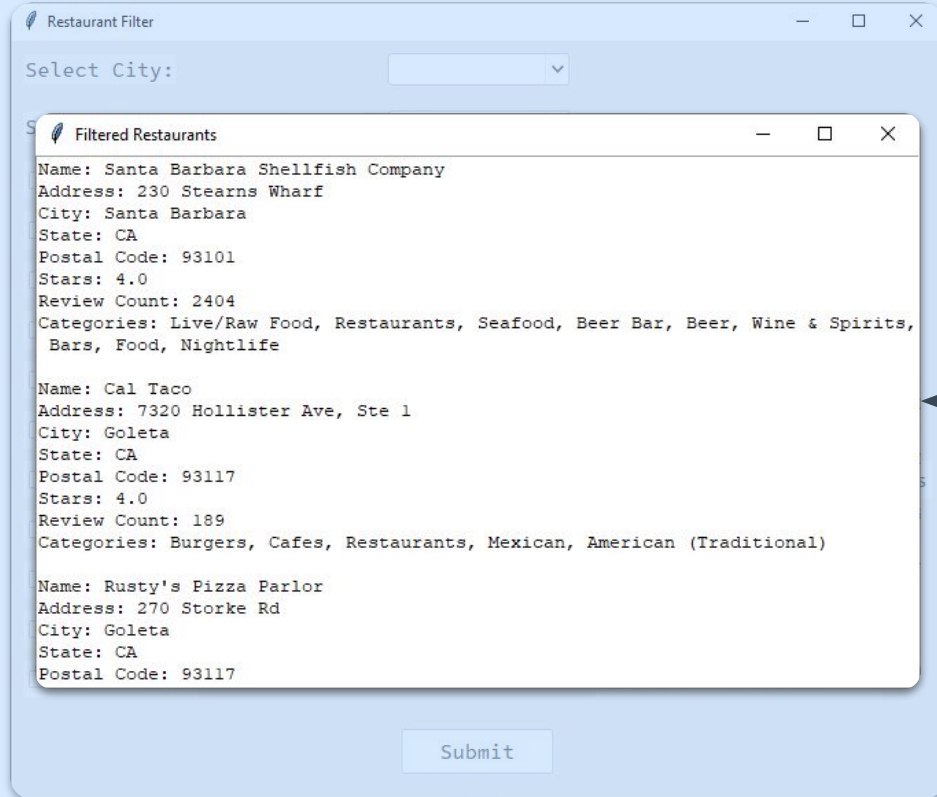
Select Minimum Star Rating:

<input type="checkbox"/> Alcohol	<input type="checkbox"/> HappyHour
<input type="checkbox"/> BYOB	<input type="checkbox"/> HasTV
<input type="checkbox"/> BikeParking	<input type="checkbox"/> Music
<input type="checkbox"/> BusinessAcceptsBitcoin	<input type="checkbox"/> Open24Hours
<input type="checkbox"/> ByAppointmentOnly	<input type="checkbox"/> OutdoorSeating
<input type="checkbox"/> Caters	<input type="checkbox"/> RestaurantsDelivery
<input type="checkbox"/> CoatCheck	<input type="checkbox"/> RestaurantsGoodForGroups
<input type="checkbox"/> DogsAllowed	<input type="checkbox"/> RestaurantsReservations
<input type="checkbox"/> DriveThru	<input type="checkbox"/> RestaurantsTakeOut
<input type="checkbox"/> GoodForDancing	<input type="checkbox"/> Smoking
<input type="checkbox"/> GoodForKids	<input type="checkbox"/> WheelchairAccessible

Submit

Allows user to search for restaurants to fit their criteria

Restaurant Filter GUI



The screenshot shows a web application window titled "Restaurant Filter". It contains a "Select City:" dropdown menu. A modal popup titled "Filtered Restaurants" is open, displaying a list of three restaurants. Each restaurant entry includes its name, address, city, state, postal code, stars, review count, and categories. The popup has a "Submit" button at the bottom.

Select City:

Filtered Restaurants

Name: Santa Barbara Shellfish Company
Address: 230 Stearns Wharf
City: Santa Barbara
State: CA
Postal Code: 93101
Stars: 4.0
Review Count: 2404
Categories: Live/Raw Food, Restaurants, Seafood, Beer Bar, Beer, Wine & Spirits, Bars, Food, Nightlife

Name: Cal Taco
Address: 7320 Hollister Ave, Ste 1
City: Goleta
State: CA
Postal Code: 93117
Stars: 4.0
Review Count: 189
Categories: Burgers, Cafes, Restaurants, Mexican, American (Traditional)

Name: Rusty's Pizza Parlor
Address: 270 Storke Rd
City: Goleta
State: CA
Postal Code: 93117

Submit

Opens popup of restaurants that fit criteria

Neural Network

- Trained a neural network on restaurant data using TensorFlow and Keras
- User can search and select one or more favorite restaurants from a list
- Neural network suggests similar restaurants



TensorFlow



Keras

Training the Neural Network

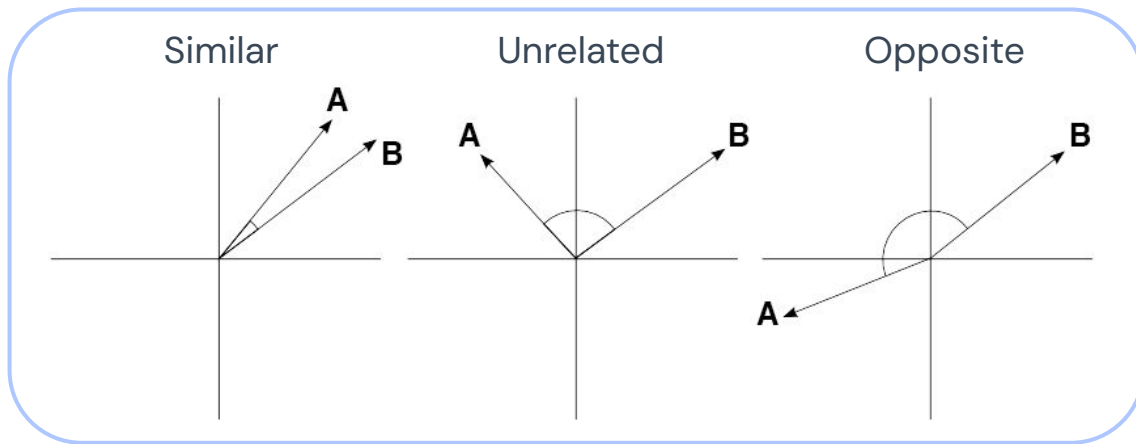
- Dimensionality is determined by the number of unique words in the TF-IDF (Term frequency Inverse document frequency) matrix
 - Creates a matrix of the less important and more important words in a restaurants.json entry
- Network is trained to reconstruct the input data, essentially predicting the TF-IDF vector for each restaurants.json entry

Making Predictions

- When the user selects one or more restaurants, the TF-IDF vectors of these restaurants are fed into the trained neural network
 - The network generates new output vectors based on the input vectors
- The output vectors are compared to the vectors of all other restaurants using cosine similarity
 - The top 10 restaurants with the highest similarity scores are returned to the user

Ranking Predictions

- The cosine similarity metric measures the cosine of the angle between two vectors
 - If two TF-IDF vectors have a small angle between them, their cosine similarity score will be closer to 1
- The restaurants are ranked based on this score, and the top 10 are shown to the user

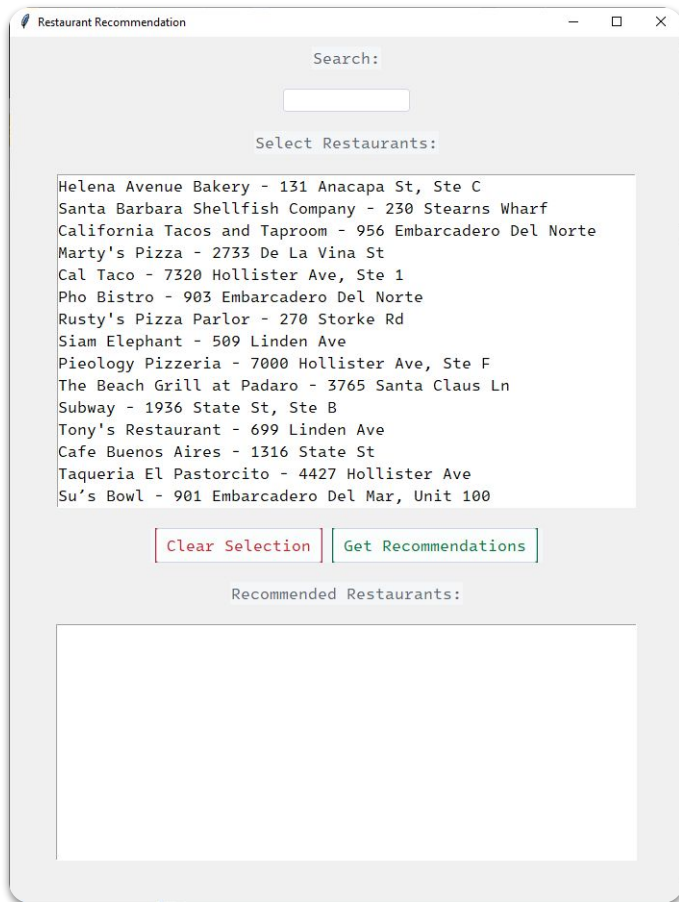


Neural Network

```
Neural Network Training
Epoch 1/10
31/31 _____ 2s 4ms/step - loss: 0.6921
Epoch 2/10
31/31 _____ 0s 3ms/step - loss: 0.6815
Epoch 3/10
31/31 _____ 0s 2ms/step - loss: 0.6315
Epoch 4/10
31/31 _____ 0s 3ms/step - loss: 0.4754
Epoch 5/10
31/31 _____ 0s 3ms/step - loss: 0.2814
Epoch 6/10
31/31 _____ 0s 3ms/step - loss: 0.1593
Epoch 7/10
31/31 _____ 0s 2ms/step - loss: 0.0975
Epoch 8/10
31/31 _____ 0s 3ms/step - loss: 0.0682
Epoch 9/10
31/31 _____ 0s 3ms/step - loss: 0.0541
Epoch 10/10
31/31 _____ 0s 3ms/step - loss: 0.0487
}
```

Program trains neural network on runtime

Neural Network (cont.)



Restaurant Recommendation

Search:

Select Restaurants:

Helena Avenue Bakery - 131 Anacapa St, Ste C
Santa Barbara Shellfish Company - 230 Stearns Wharf
California Tacos and Taproom - 956 Embarcadero Del Norte
Marty's Pizza - 2733 De La Vina St
Cal Taco - 7320 Hollister Ave, Ste 1
Pho Bistro - 903 Embarcadero Del Norte
Rusty's Pizza Parlor - 270 Storke Rd
Siam Elephant - 509 Linden Ave
Pieology Pizzeria - 7000 Hollister Ave, Ste F
The Beach Grill at Padaro - 3765 Santa Claus Ln
Subway - 1936 State St, Ste B
Tony's Restaurant - 699 Linden Ave
Cafe Buenos Aires - 1316 State St
Taqueria El Pastorcito - 4427 Hollister Ave
Su's Bowl - 901 Embarcadero Del Mar, Unit 100

[Clear Selection](#) [Get Recommendations](#)

Recommended Restaurants:

To use the neural network, the user can select their favorite restaurants in our application

Neural Network (cont.)

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Recommended Restaurants:

Recommended Restaurants:

1. Meun Fan Thai Cafe - 5664 Calle Real
2. TAP Thai Cuisine - 7060 Hollister Ave, Ste 106
3. Bangkok Palace - 2829 De La Vina St
4. Your Place Thai Restaurant - 22 N Milpas St, Ste A
5. TAP Thai Cuisine - 2611 De La Vina St
6. Pattaya Thai Restaurant - 5918 Hollister Ave
7. East - 1208 State St
8. Meun Fan Thai Cafe - 1819 Cliff Dr
9. Galanga Thai Restaurant - 507 State St
10. Zen Yai Thai Cuisine - 425 State St

Application gives suggestions for similar restaurants

Evaluating Accuracy?

- Data is generated based on specific user preferences
 - We do not track what restaurants the user goes to
- Integrate Yelp log-in to track if a user goes to a suggested restaurant and the score of their review



Demo