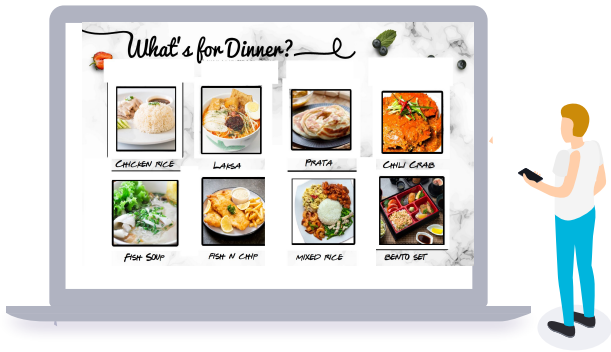
Content Recommendation using Eye Gaze & Face Recognition

By: Tricia Lam & Jovester Chai



Contents

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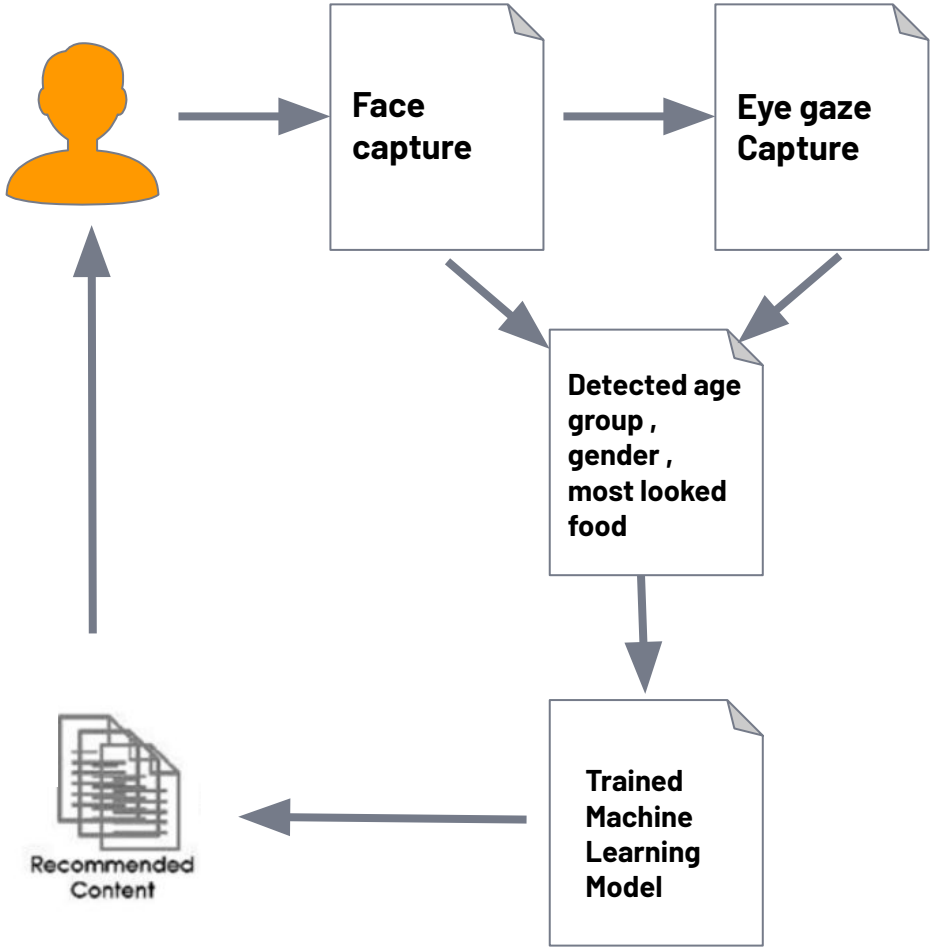
The project seeks to predict food recommendations through the analysis of human's eye gaze and facial recognition

We aim to create a **reliable** application that provides users of all ages and gender with good food recommendations.

Key features included in our system:

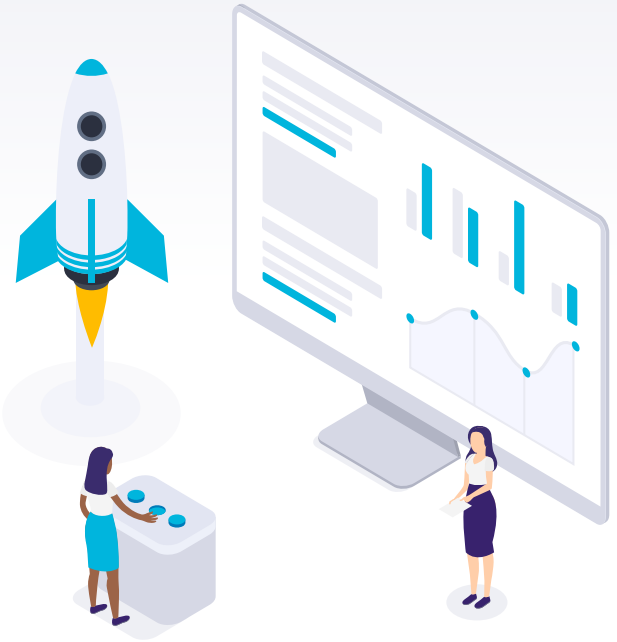
1. Eye Gaze Tracking
2. Integrated facial recognition into existing application
3. Machine Learning Recommender
4. Practical application for users to use

System Design


Face capture
Eye gaze Capture
Detected age group , gender , most looked food
Trained Machine Learning Model
Recommended Content

Statement Of Work

- What is needed?
- What are our objectives?



Statement Of Work

What is needed?

- A batch of Data for Machine Learning purposes.
- Suitable Model and Algorithm to train Data

What are our objectives?

- **Objective 1** :
  - Train a Model with Data and Algorithm
  - Integrate trained Model
- **Objective 2** :
  - Implement suitable Model to recommend food items

What have we done so far

Sprint 1

Jovester

- ✓ Implement smile detection into facial recognition
- ✓ Integrate facial recognition into the deployable codes
- ✓ Integrate Collaborative Filtering Model into the facial recognition and eye tracking

Tricia

- ✓ Conduct Survey
- ✓ Update UX for the pages
- ✓ Data preparation
- ✓ Building & Implementing the embedded Collaborative Filtering Model into the deployable code

Sprint 2

Jovester

- ✓ Project outline
- ✓ Use a decision tree model for the recommender system

Tricia

- ✓ Designed and improved powerpoint slides
- ✓ Drew the System design
- ✓ Work on neural network collaborative filtering model
- ✓ Work on 2 collaborative model in which both uses different feature vectors
- ✓ Added evaluation metrics for each models
- ✓ Collected more data
- ✓ Do model comparison
- ✓ Integrate best model into app
- ✓ Fixed bugs on the app

Differences between new and old Dataset

Old

- Ratings
- Food Descriptions
- Address
- 24 rows of food records

NEW

- Ratings
- Food Descriptions
- Address
- **Age Group**
- **Gender**
- **Top 6 food preferences**
- **1000 rows of user and food record**

We've successfully built 4 different models

How we utilize the dataset in our model

Our 4 models mainly fall in this 3 types of model..

1 Decision Tree

Label Encoding features into dummy features.

Combine the food items data (0, 1) into a single string
- Eg, 000010000001101000001001

Input : gender (dummy), age (dummy) and food item combination.

Output: 6 selected food items of similar users

2 Collaborative Filtering

Age Group + Gender = User group

1st Model :
- Vectors in the user-food matrix have been directly used as feature vectors

2nd Model:
- Singular value decomposition has been used to generate feature vectors.

How we utilize the dataset in our model

3 Neural Network

One hot encode categorical datas

For every row of records , loop them, so that the i th food in the row is the indicated food and the next food(k th) chosen by user will be the recommended food for that user .

Before:

UserID	Gender	Age Group	laksa	Chili Crab	Char Kway Teow	Japanese Bento	Curry laksa
1	Female	65 and above	0	1	0	1	1

After:

	gender	age_group	indicated_food	rcmd_food
0	0	2	0	2
1	0	2	0	3
2	0	2	0	5
3	0	2	0	7
4	0	2	0	12

Model Evaluation

Decision Tree	Neural Net Collaborative Filtering
• Score: 0.08% • Accuracy: **37% - 22%**	• Accuracy: 13.22% • Classification Accuracy: 50% • Intersection metrics: **0.501**

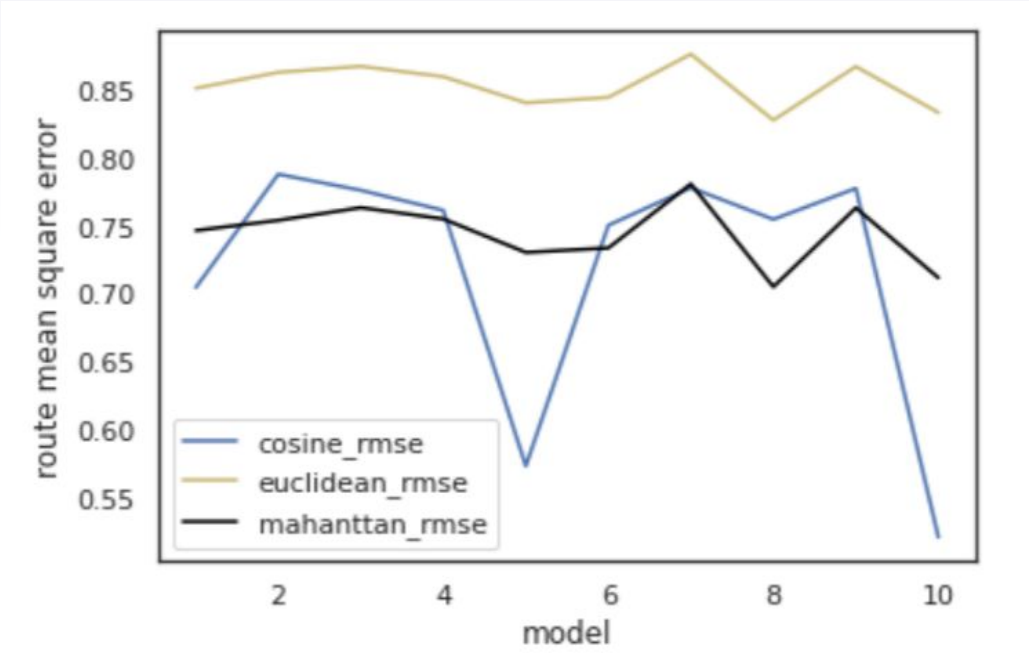
Model Evaluation (Sprint2)

Collaborative filtering (SVD)	Collaborative filtering (user-food matrix & **cosine similarity**)
• RMSE : 1.0350 • MSE: 1.071	• RMSE:**0.691** • MSE: **0.527**

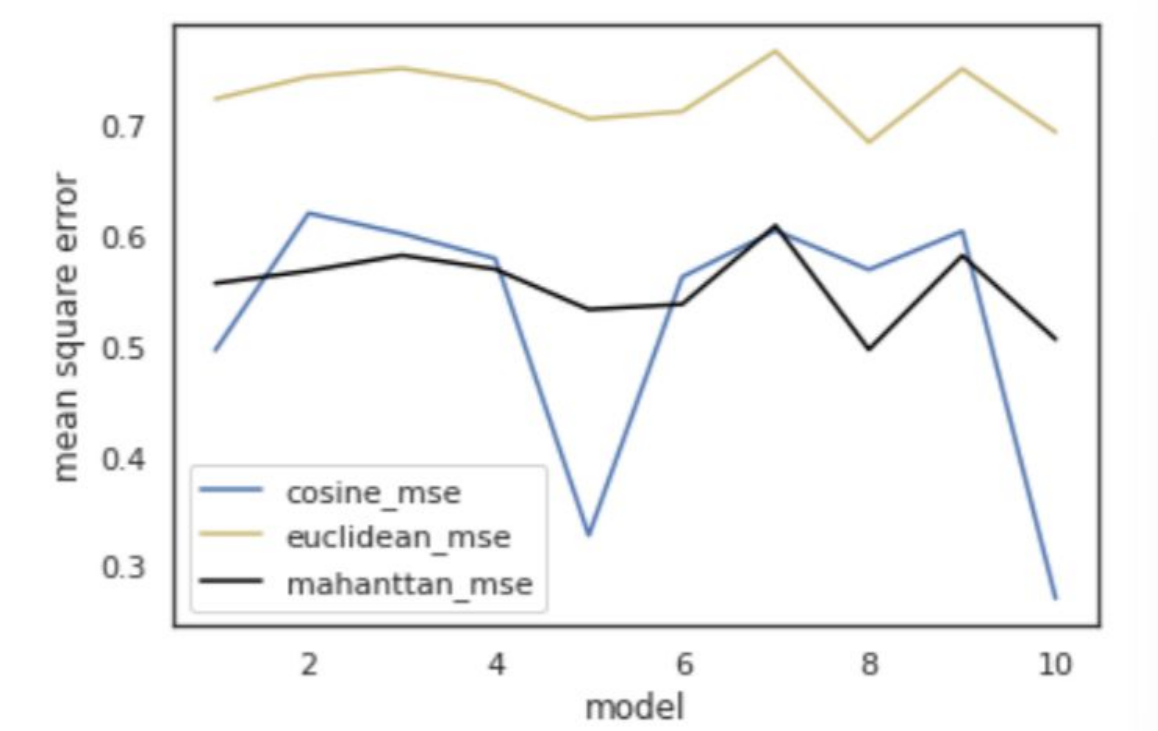
Model Evaluation (Sprint 3)

Collaborative filtering (SVD)	Collaborative filtering (user-food matrix & **cosine similarity**)	Collaborative filtering (user food matrix & **euclidean distance**)	Collaborative filtering (user food matrix & **Manhattan distance**)
• RMSE : 1.0350 • MSE: 1.071	• RMSE:**0.720** • MSE: **0.527**	• RMSE : 0.848 • MSE: 0.720	• RMSE : 0.736 • MSE: 0.543

Graph - RMSE


route mean square error
0.85
0.80
0.75
0.70
0.65
0.60
0.55
cosine_rmse
euclidean_rmse
mahanttan_rmse
2
4
6
8
10
model

Graph - MSE


mean square error
0.7
0.6
0.5
0.4
0.3
cosine_mse
euclidean_mse
mahanttan_mse
2
4
6
8
10
model

Predictions

Example : Female , 65 and above , Sliced Fish Soup

Cosine model

- Chinese Economy Rice
- Crab Bee Hoon Soup
- Bak Kut Teh
- hainanese chicken rice
- Hokkien Mee

Euclidean Model

- Chinese Economy Rice
- Crab Bee Hoon Soup
- Bak Kut Teh
- Duck Rice
- Roti Prata

Manhattan Model

- Chinese Economy Rice
- Crab Bee Hoon Soup
- Bak Kut Teh
- Duck Rice
- Hokkien Mee

Model Evaluation

Decision Tree	Neural Net Collaborative Filtering	Collaborative filtering (SVD)	Collaborative filtering (vectors in the user -food matrix)
• Score: 0.08% • Accuracy: - 37% - 22%	• Accuracy: 13.22% • Classification Accuracy: 50% • Intersection metrics: 0.50	• RMSE : 1.0350 • MSE: 1.071	• RMSE:0.691 • MSE: 0.527

Thus , considering the **size of our dataset** and our **use case scenario** while evaluating how the various **model performs** , we chose to go with the **Collaborative filtering that uses vectors in the user -food matrix.**

What are we going to do next

Sprint 3

Jovester

- Try out some other more models
- Help out Tricia if necessary

Tricia

- Collect more data to improve the accuracy of the neural network model
- Change the description of the recommendations , so that it will only appear when user hover around the picture
- Try out more algorithms
- Make the app less buggy

Sprint 4

Jovester

- Add more features into application
- Give the application a better look

Tricia

- Change the previous batch's facial recognition codes to a new codes so that age + gender detection would be more accurate
- Menu selection -> user can choose which of the 3 menu they wished to view
- Changed the interface of the app

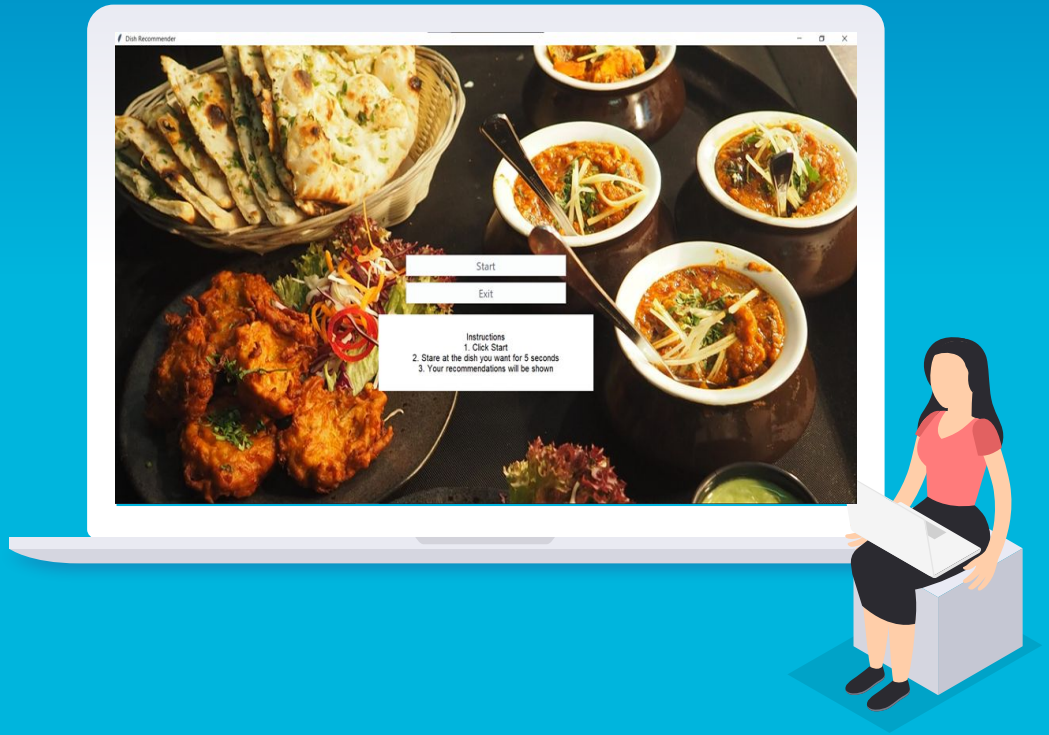
Problems Encountered (Tricia)

1. **Challenging to find the best model that fits our user scenario**
2. **Insufficient dataset**

Problems Encountered (Jovester)

1. **Lack of rating feature in dataset**
    a. Without the rating feature , the confidence score of models would drop

DEMO


Dish Recommender
Start
Exit
Instructions
1. Click Start
2. Stare at the dish you want for 5 seconds
3. Your recommendations will be shown

THANKS!

Any questions?