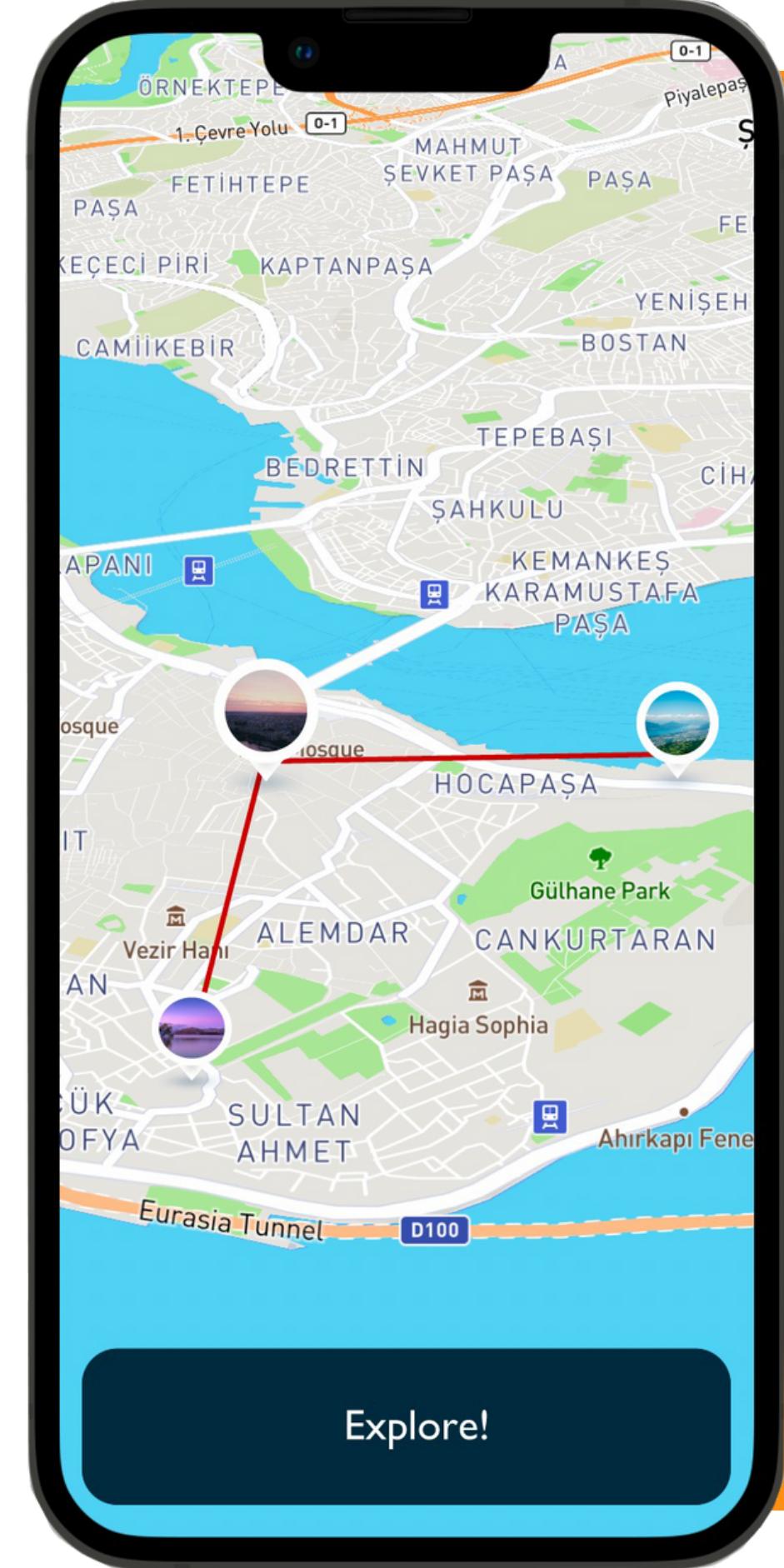


CAPSTONE PROJECT

TRAVEL BUDDY



Agenda



Part 1

Introduction & Context

Part 2

Business & Industry Overview

Part 3

Data Architecture

Part 4

Web App

Part 5

Exploratory Data Analysis

Part 6

Machine Learning

Part 7

Machine Learning Ops.

Part 8

Next Steps

...

...

Introduction & Context



Introduction & Context

Final Capstone Project

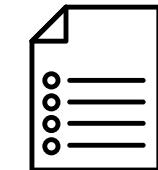
- Own project vs Companies
- Goal: MVP based on AI/ML techniques

Business Challenges

- Product/Market Fit
- Industry Size & Competitors
- USP & Monetization

Data & Tech Challenges

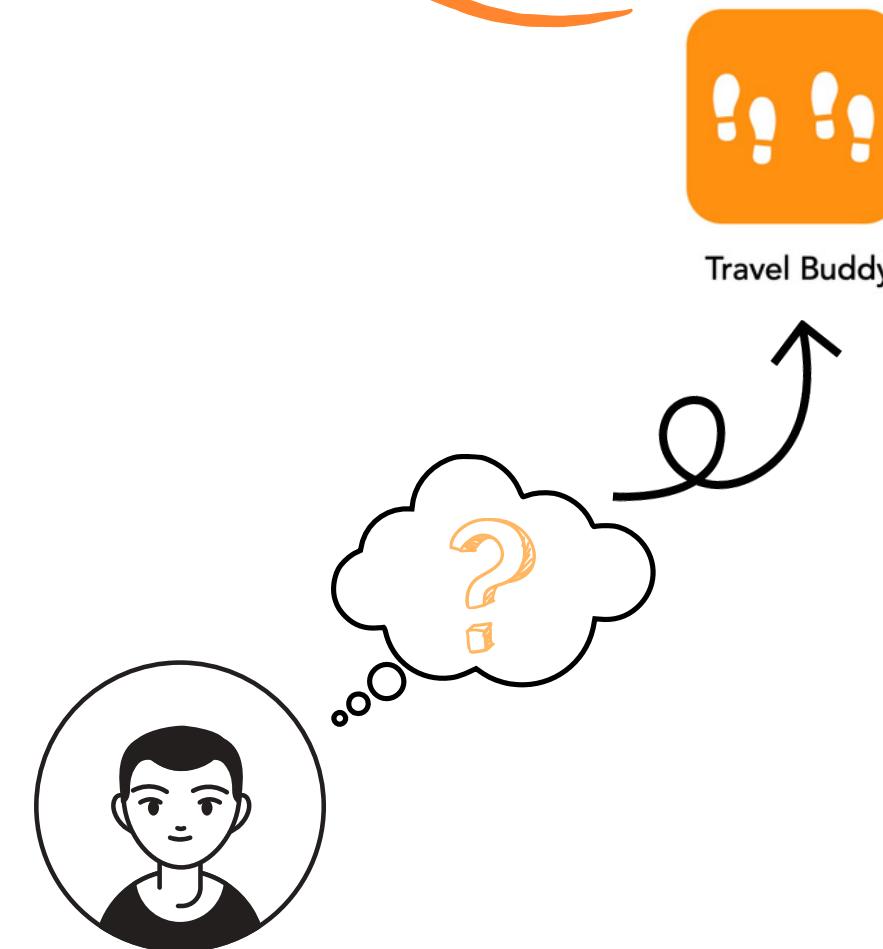
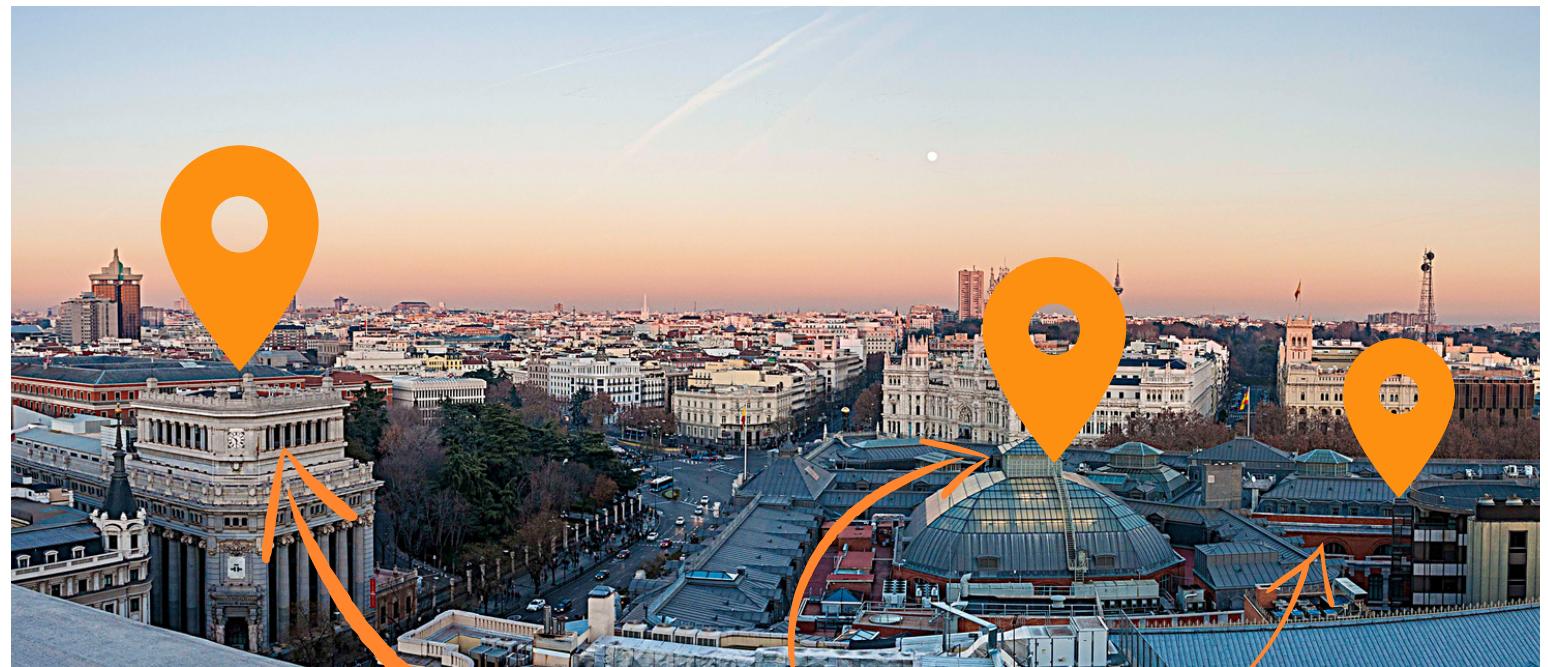
- No existing datasets
- Need for end-to-end MLOps pipeline:
 - 1) Data Sources/Ingestion
 - 2) Data Validation & Storage
 - 3) Data Processing & Model Training/Tuning
 - 4) Serving Results
 - 5) Model Evaluation & Feedback Loop



...

TravelBuddy

- ✓ Smart Travel Application
- ✓ Discover new places & find the best way around a new city
- ✓ Fully personalized by leveraging recommendation algorithms



...

Business & Industry Overview



...

Primary Market Research

Product/Market Fit & Customer Profile



Total unique respondents: 143

Limitations

- Relatively small n of respondents
- Biased by large n of IE students

First feeling of market potential

4 main categories:

- Demographics
- Traveler Profile
- Planning Profile
- App Opinions



...

Primary Market Research:

Product/Market Fit & Customer Profile



Main target group identified

- Millennial or Gen Z
- Digital natives
- Culture & exploration travelers
- Budget: 650€ - 1,000€
- Avg. trip duration: 4-6 days

User-habits

- 39% overwhelmed when arriving in new city
- 80% willing to spend at least 10€ - 20€ for planning trips
- 77% spend moderate amount of time on planning



Top 3 requested features



1

PLACE RECOMMENDATIONS

2

ROUTE RECOMMENDATIONS

3

AUTOMATIC RESERVATIONS



Secondary Market Research:

Business Environment

Direct competitors:

Online Travel Market

Total Rev.:

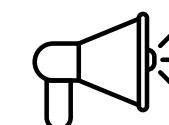
- 2020: US\$ 396 billion
- 2021: US\$ 433 billion
- 2026: US\$ 690 billion

Tripadvisor



Revenue:

- 2019: US\$ 1.560 million
- 2020: US\$ 604 million
- 2021: US\$ 902 million



Data confirms viability of pursuing business model focused on online & mobile travel market



...

Secondary Market Research:

Key Trends

AI/ML & leveraging Big Data

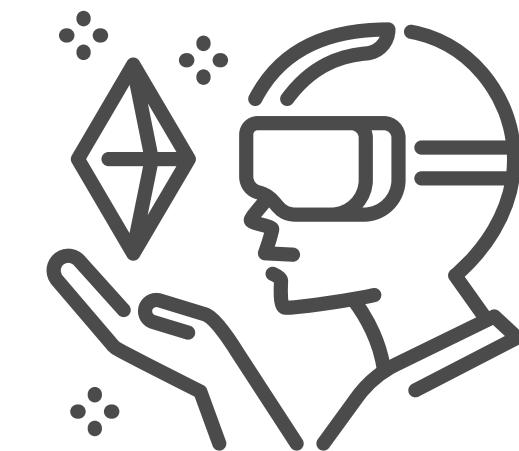
- Better analytics
- Dynamic pricing
- Hyper-personalization

Augmented and Virtual Reality

- Millennials & Gen Z purchasing habits driven by "smart" features

Travel Applications

- GlobalData Q4 Consumer Survey - *Online booking platforms more popular than offline counterparts*



...

Secondary Market Research

Evaluation of Business Environment - USP Matrix

	TRAVEL BUDDIES	QUESTO	GPSMYCITY	CLIO MUSE
COSTUMIZED TOURS	★	★	★	★
GPS	★	★	★	★
PERSONALIZED TOURS	★			
AUDIO GUIDES	★		★	★
OFFLINE CONTENT	★		★	★
WEB APPLICATION	★	★	★	★
ARTICLES			★	
VOICE DIRECTION			★	
GAMES	★	★		
EVENTS		★		
GIFTS	★	★		
AR	★	★		



...

Secondary Market Research

Monetization Strategies

Advertisement

- Many implementation opportunities
- Negative impact on UX

Pay-for-Service / Freemium Model

- Depends on range of features / use-cases
- Cost/Benefit calculation
- Monetizing basic personalized recommendations bad strategy

Partnership Networks & Special Package

- Many implementations/opportunities to explore
- Example: Partner with companies/travel groups to offer packaged services
- Benefit for ML-model: Many users/data at once
- Benefit for business: Increased downloads/potential users



Product Development Strategy

...



...

MVP Challenge

How to overcome the cold-start problem?

1

Baseline recommender

2

Deliver a perfect day



Preference
elicitation



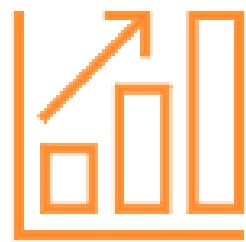
Feature
Mapping



Hybrid
Recommender

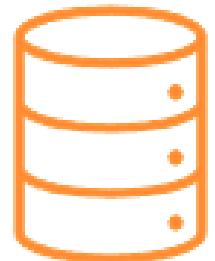
...

Measuring Performance



Value proposition

- Avg. user ranking
- Avg. user sentiment



Data

- % observations preserved
- % users preserved



Model

- RMSE
- Bias



System

- Bugs



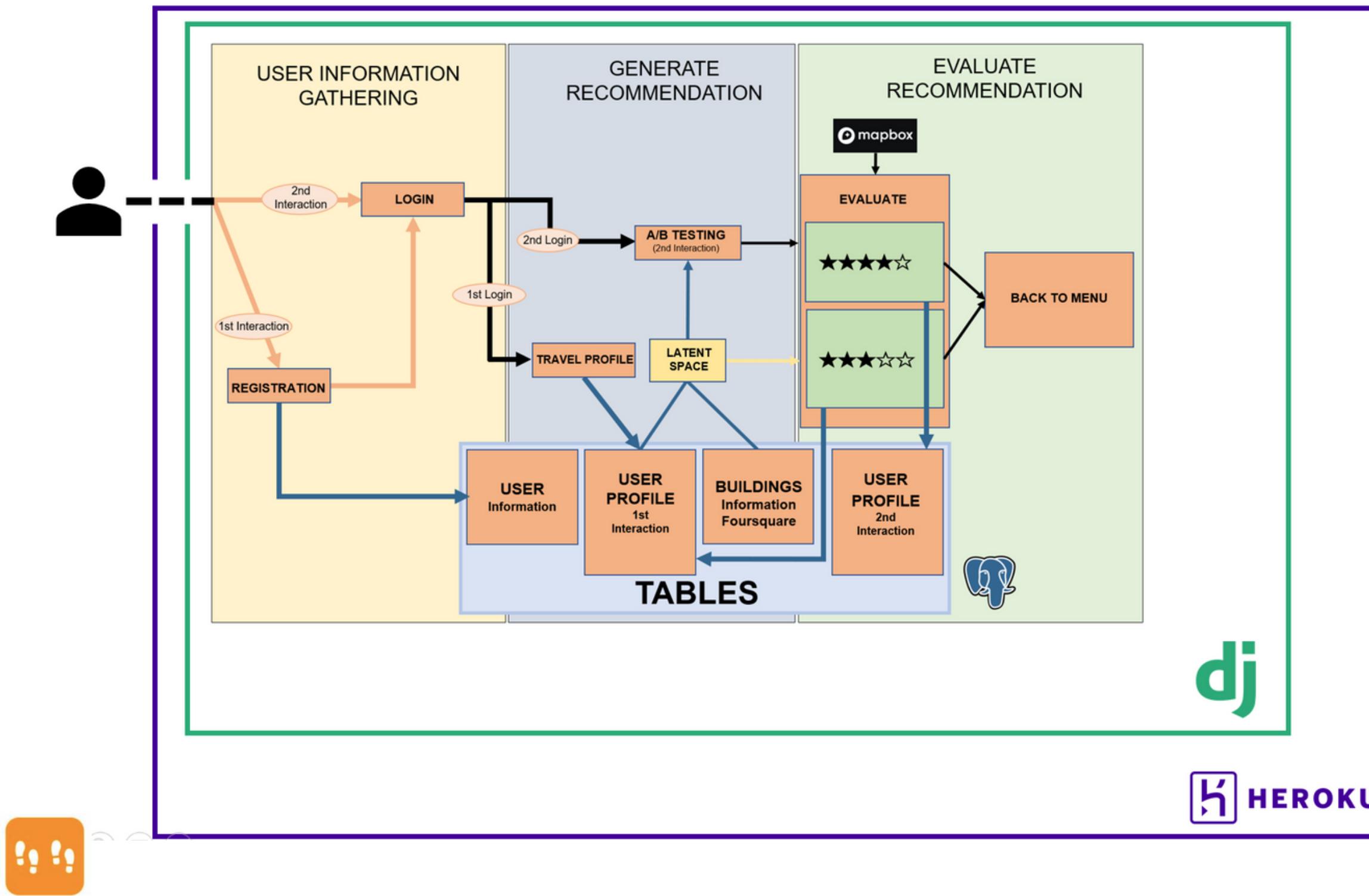
...

Data Architecture



Data Architecture

...

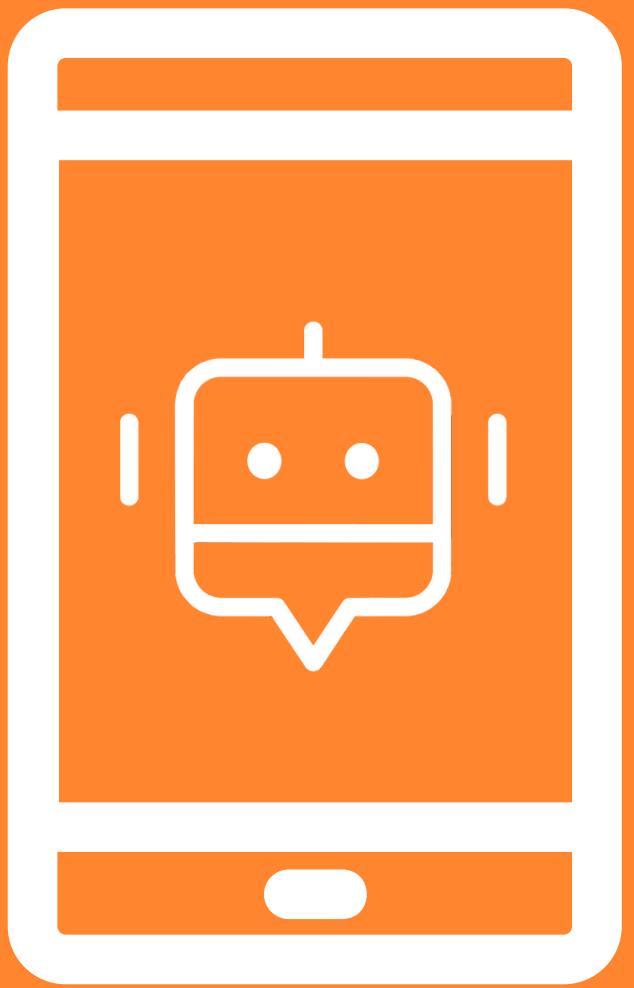


GOALS

- ✓ User-friendly interface
- ✓ Solid back end
- ✓ Cost-efficiency

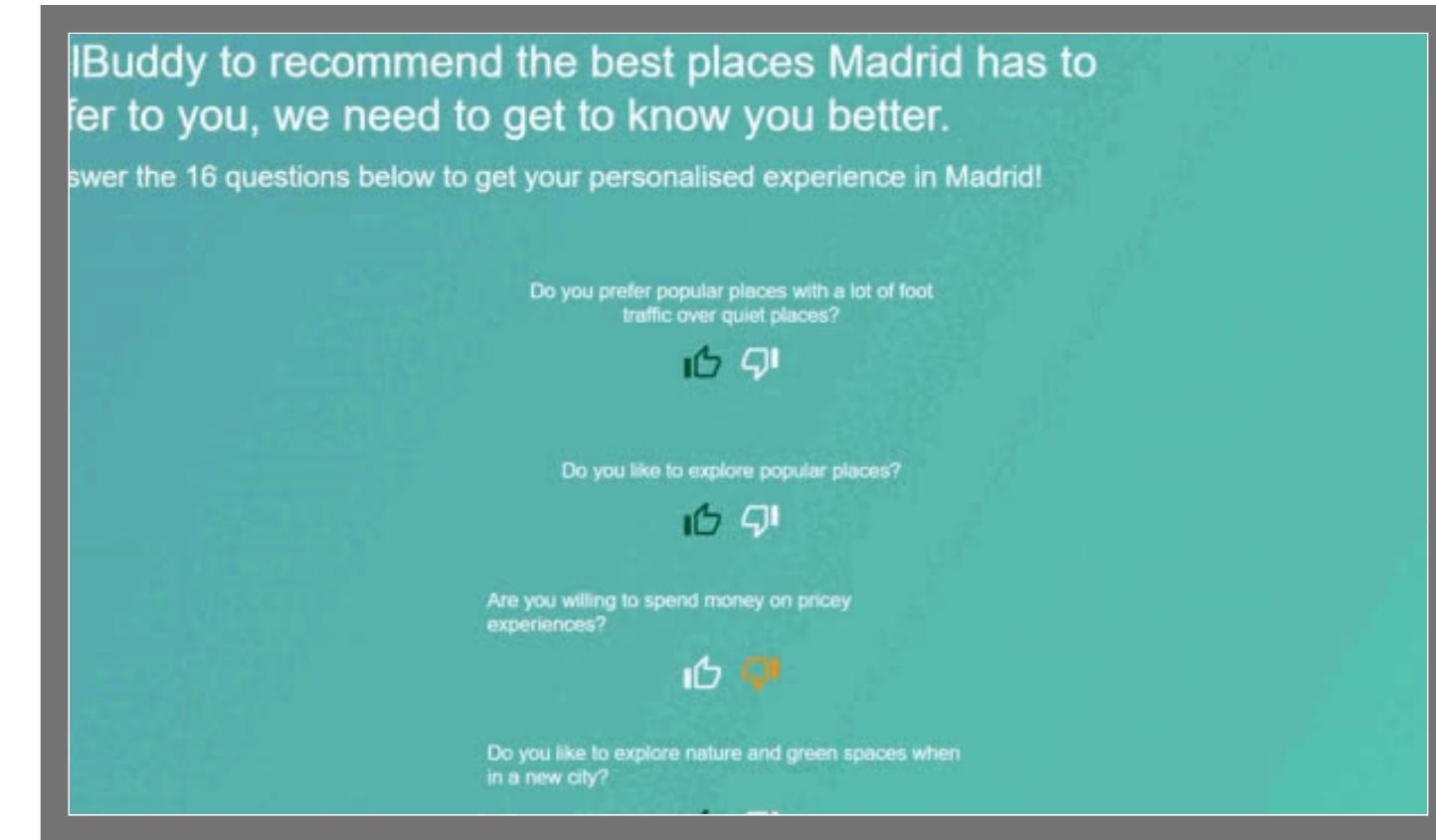
...

Web App



Web App

...



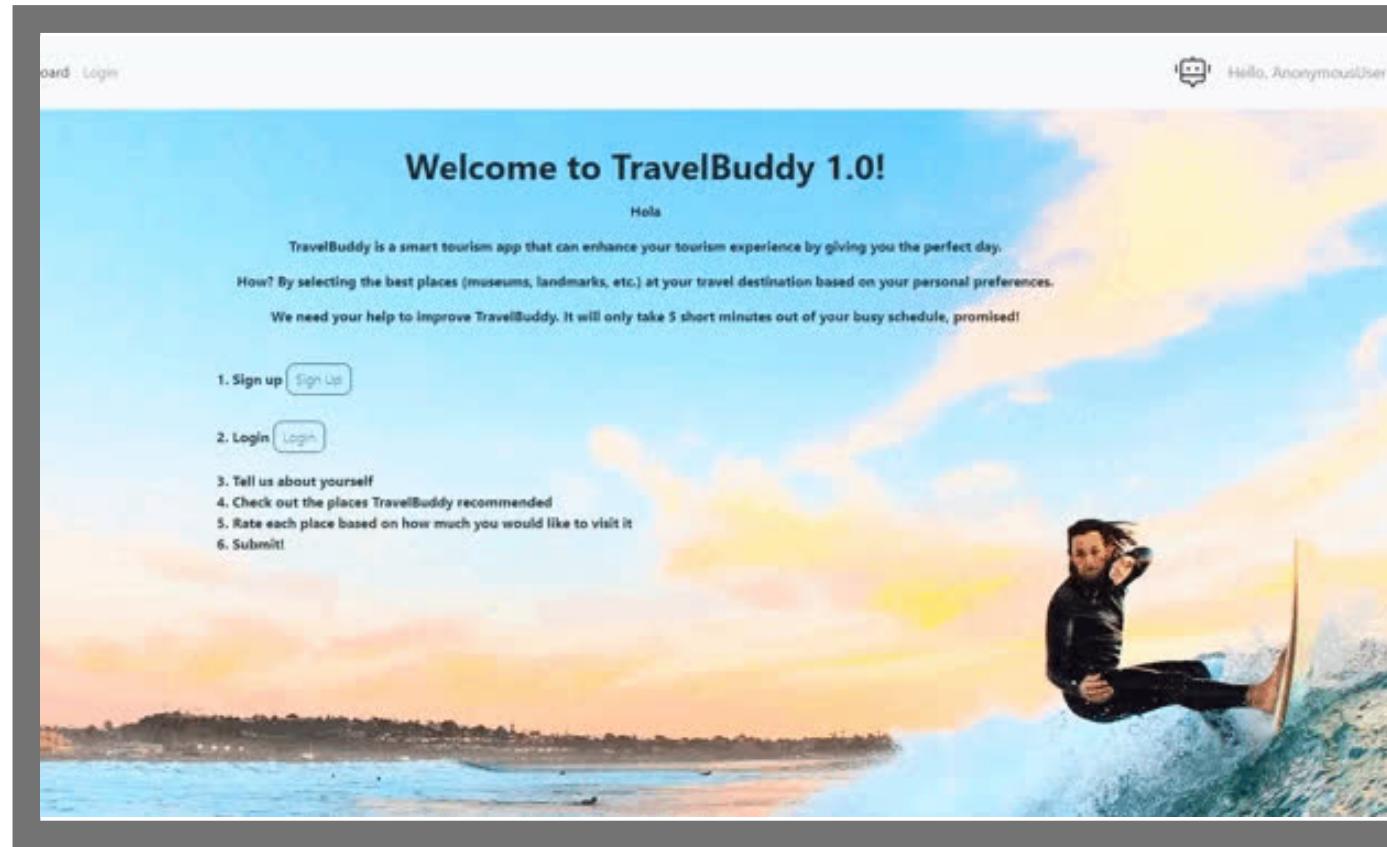
I Buddy to recommend the best places Madrid has to offer to you, we need to get to know you better. Answer the 16 questions below to get your personalised experience in Madrid!

Do you prefer popular places with a lot of foot traffic over quiet places?

Do you like to explore popular places?

Are you willing to spend money on pricey experiences?

Do you like to explore nature and green spaces when in a new city?



Welcome to TravelBuddy 1.0!

Hello, AnonymousUser

TravelBuddy is a smart tourism app that can enhance your tourism experience by giving you the perfect day. How? By selecting the best places (museums; landmarks, etc.) at your travel destination based on your personal preferences. We need your help to improve TravelBuddy. It will only take 5 short minutes out of your busy schedule, promised!

1. Sign up [Sign Up](#)

2. Login [Login](#)

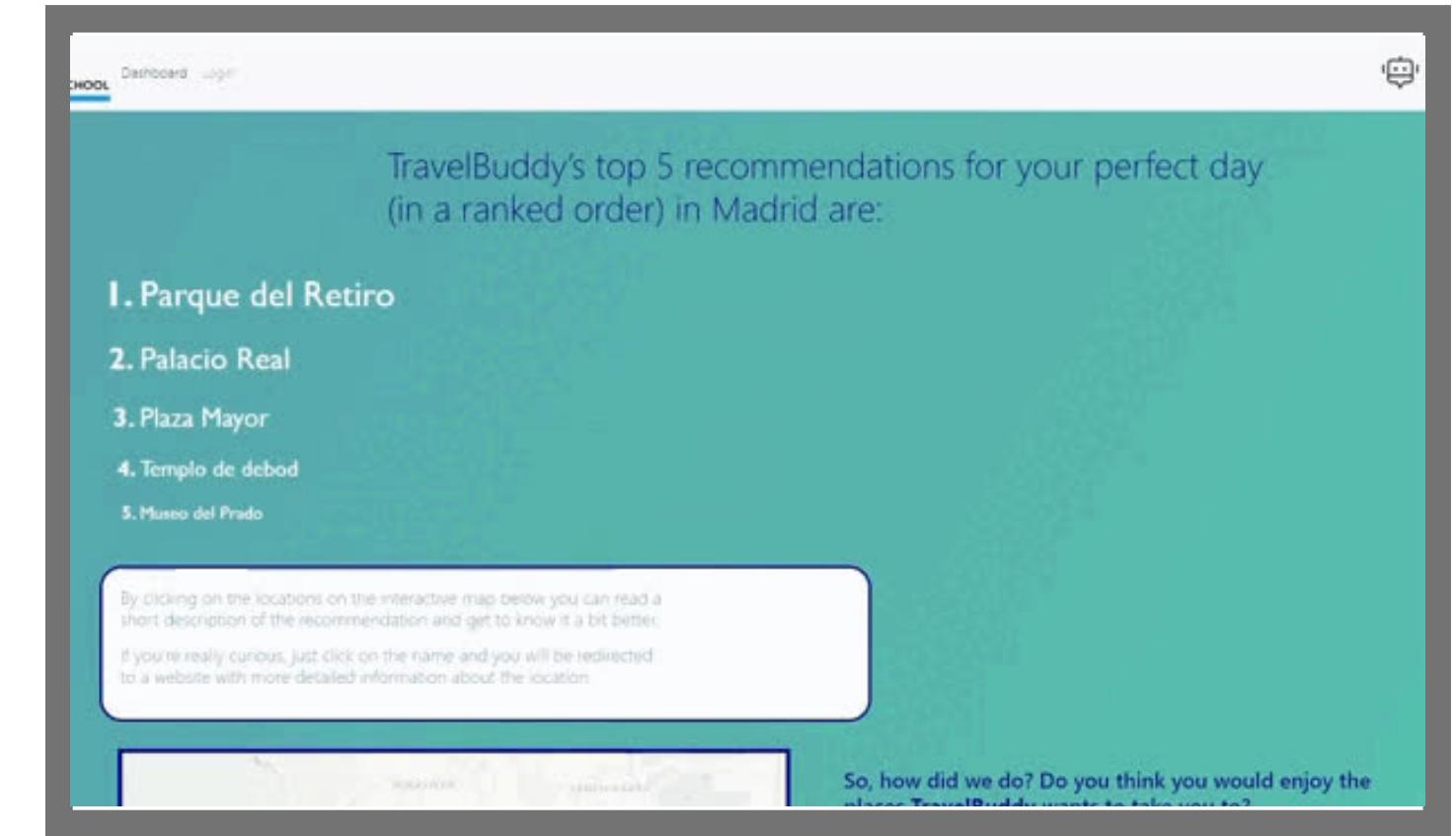
3. Tell us about yourself

4. Check out the places TravelBuddy recommended

5. Rate each place based on how much you would like to visit it

6. Submit!

A man surfing on a wave against a sunset background.



TravelBuddy's top 5 recommendations for your perfect day (in a ranked order) in Madrid are:

1. Parque del Retiro
2. Palacio Real
3. Plaza Mayor
4. Templo de debod
5. Museo del Prado

By clicking on the locations on the interactive map below you can read a short description of the recommendation and get to know it a bit better. If you're really curious, just click on the name and you will be redirected to a website with more detailed information about the location.

So, how did we do? Do you think you would enjoy the places TravelBuddy wants to take you to?

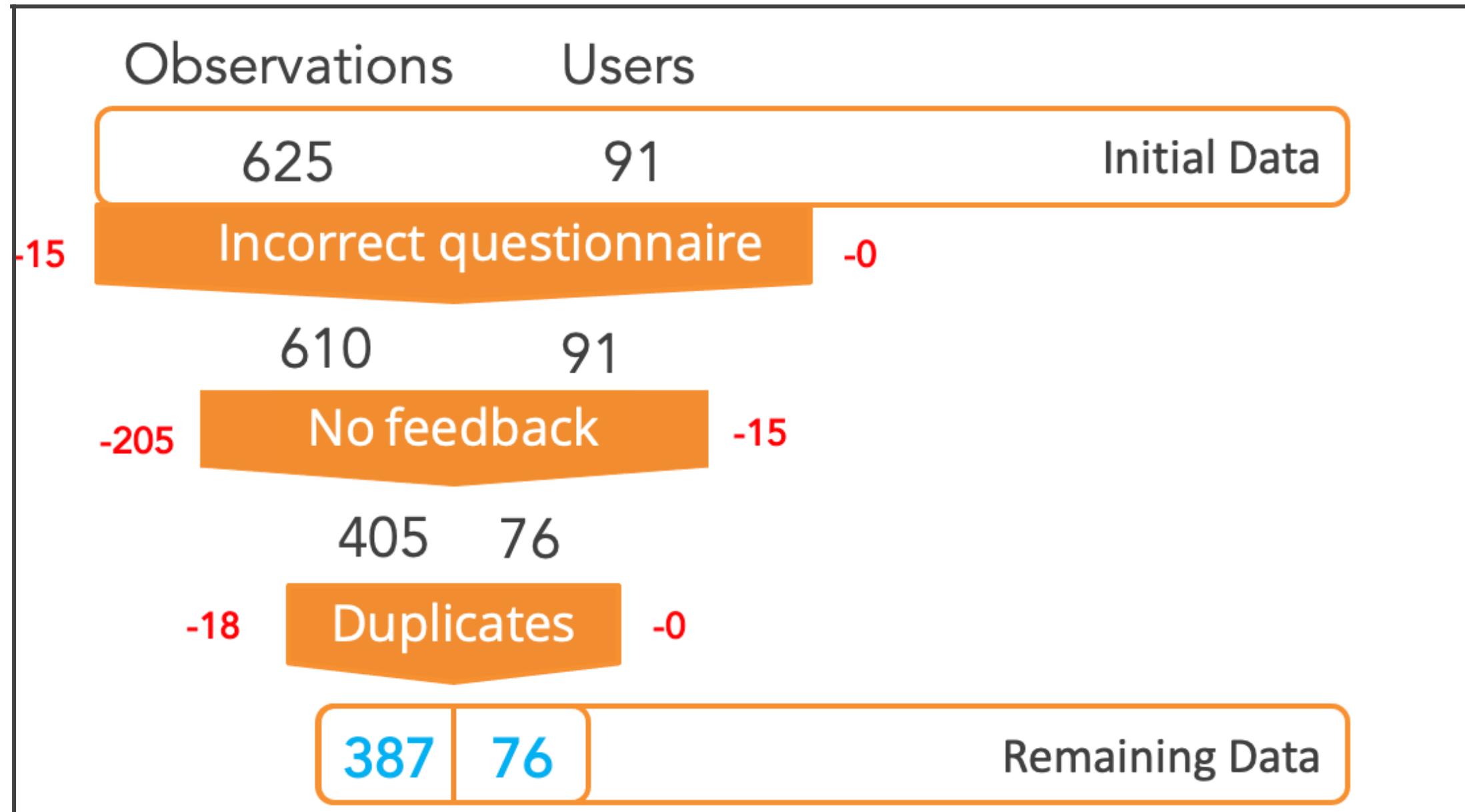
...

Exploratory Data Analysis



...

Data Exploration



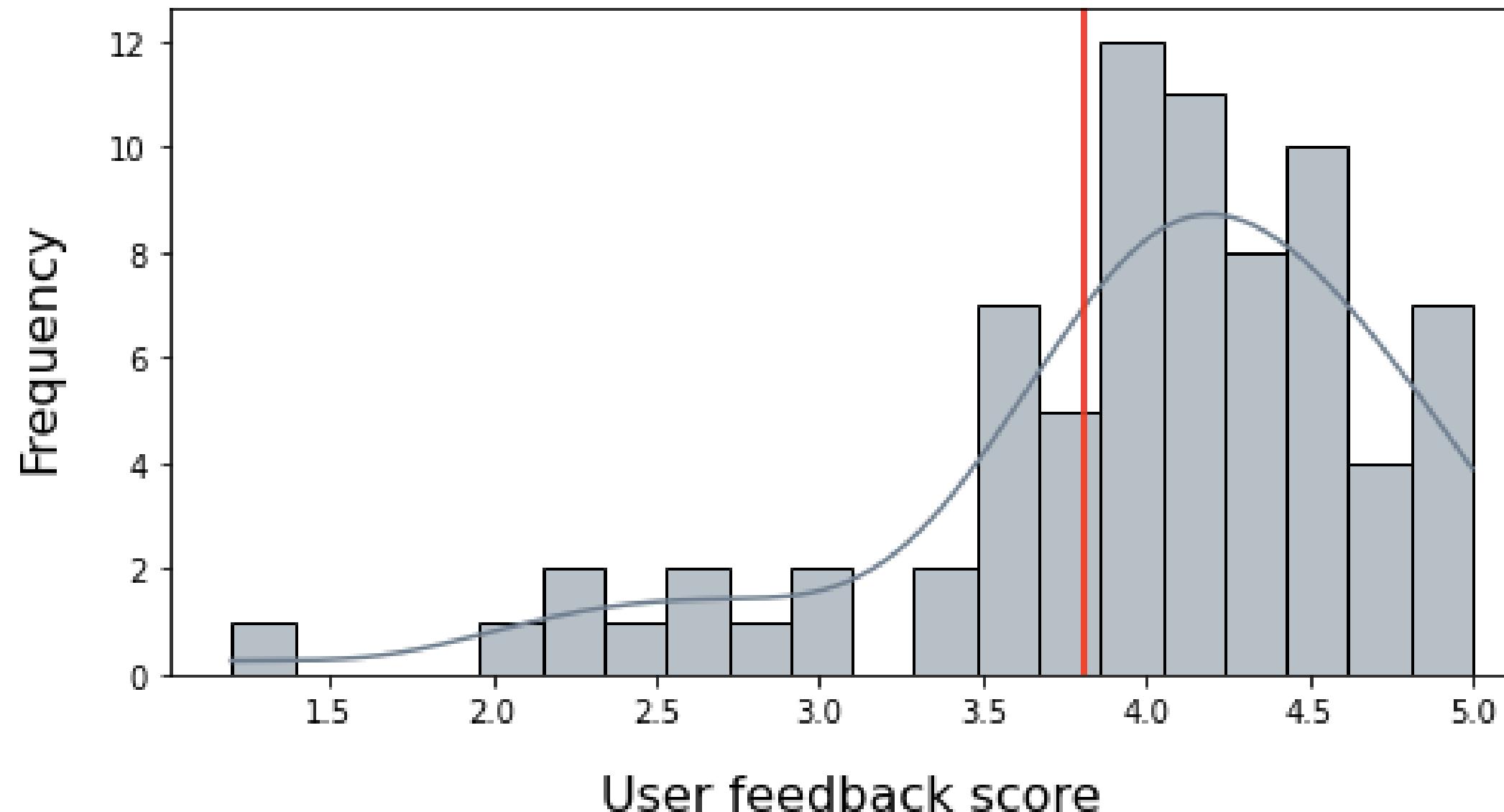
INSIGHTS

Only 62% of initial observations and 84% of initial users were valid



...

Our users are happy !



Avg. user happiness

3.8



Avg. user sentiment*

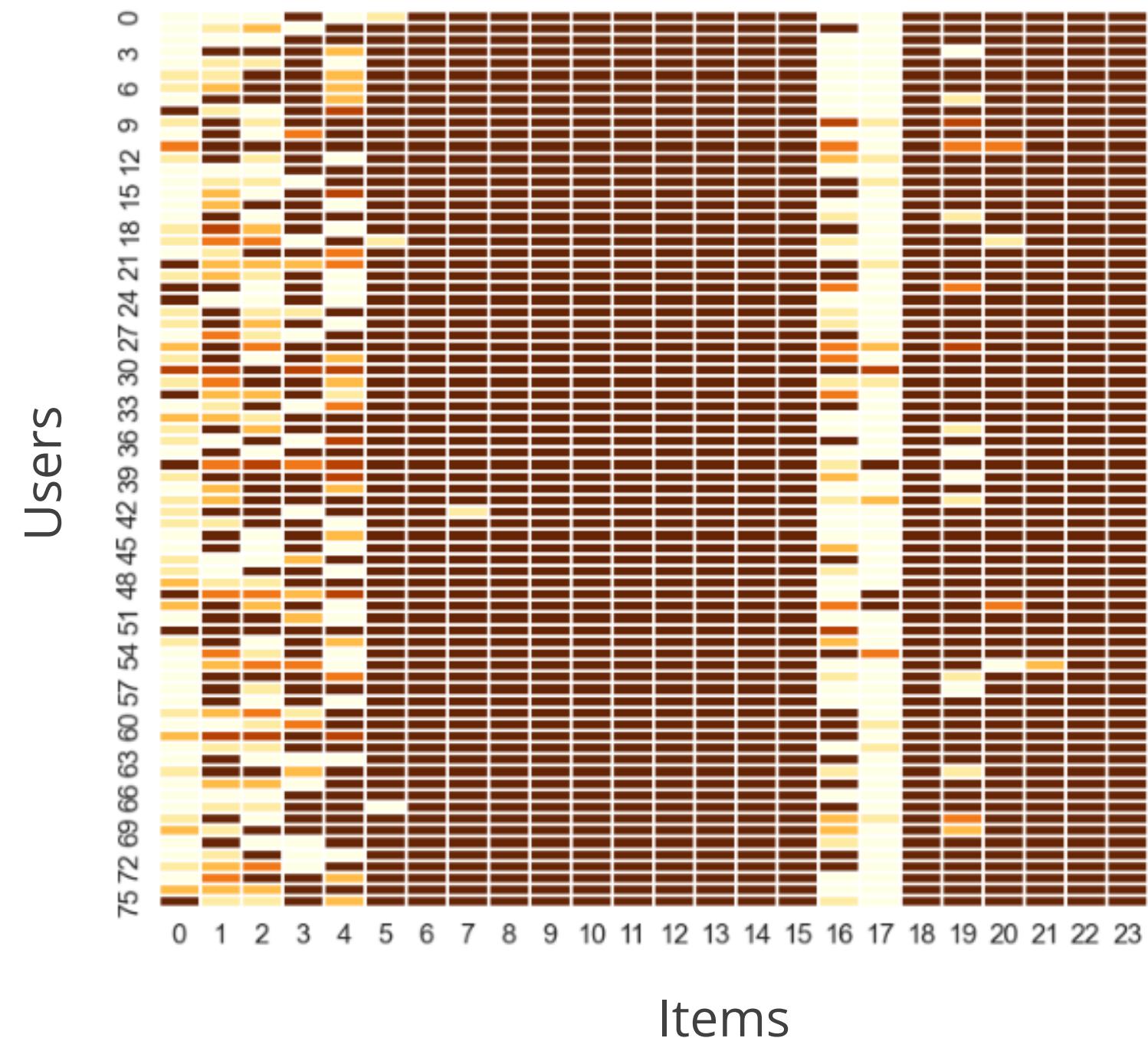
30%



*Sentiment measured from comments left by 24 users

Our recommender is biased

...



Total items recommended

12

Prop. of top 5 items

87%



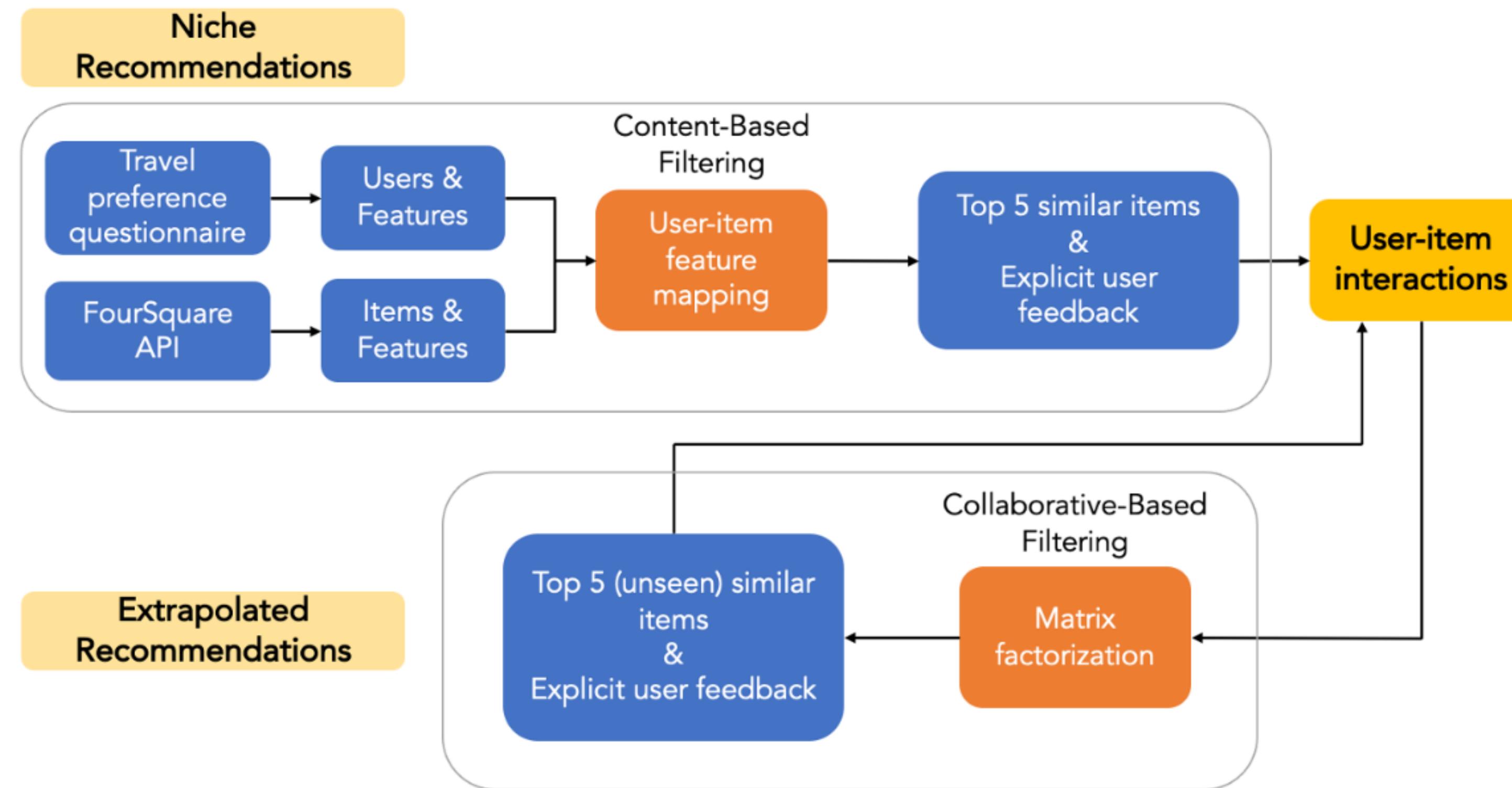
...

Machine Learning



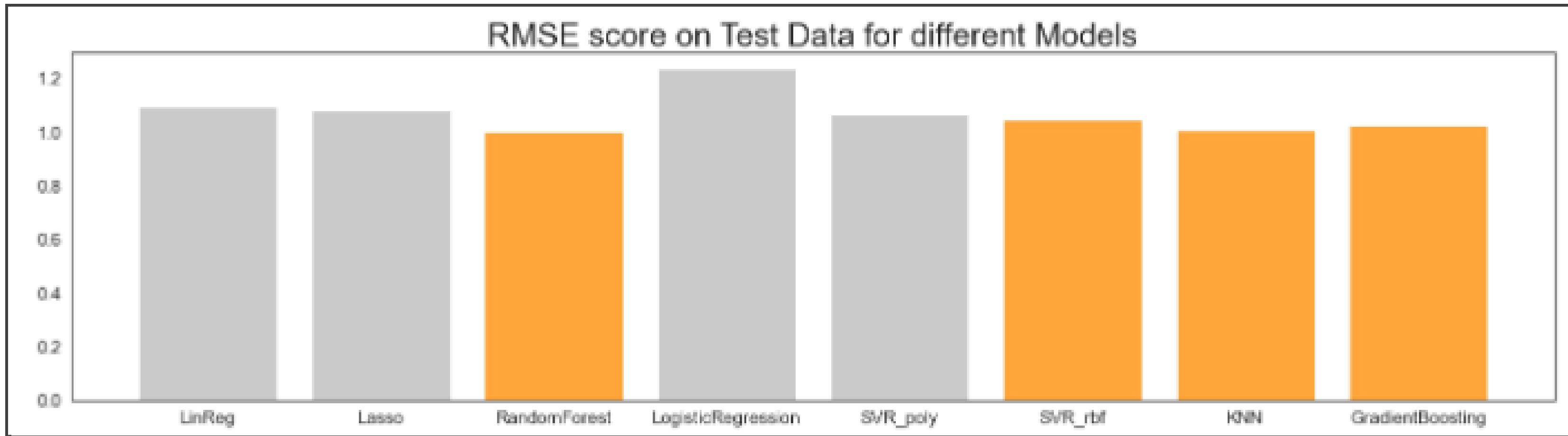
...

Machine Learning Pipeline



Baseline Models

...



Algorithm	RMSE Score	Algorithm	RMSE Score
SVM (rbf kernel)	1.048	Random Forest	1.003
Gradient Boosting	1.027	KNN	1.003



...

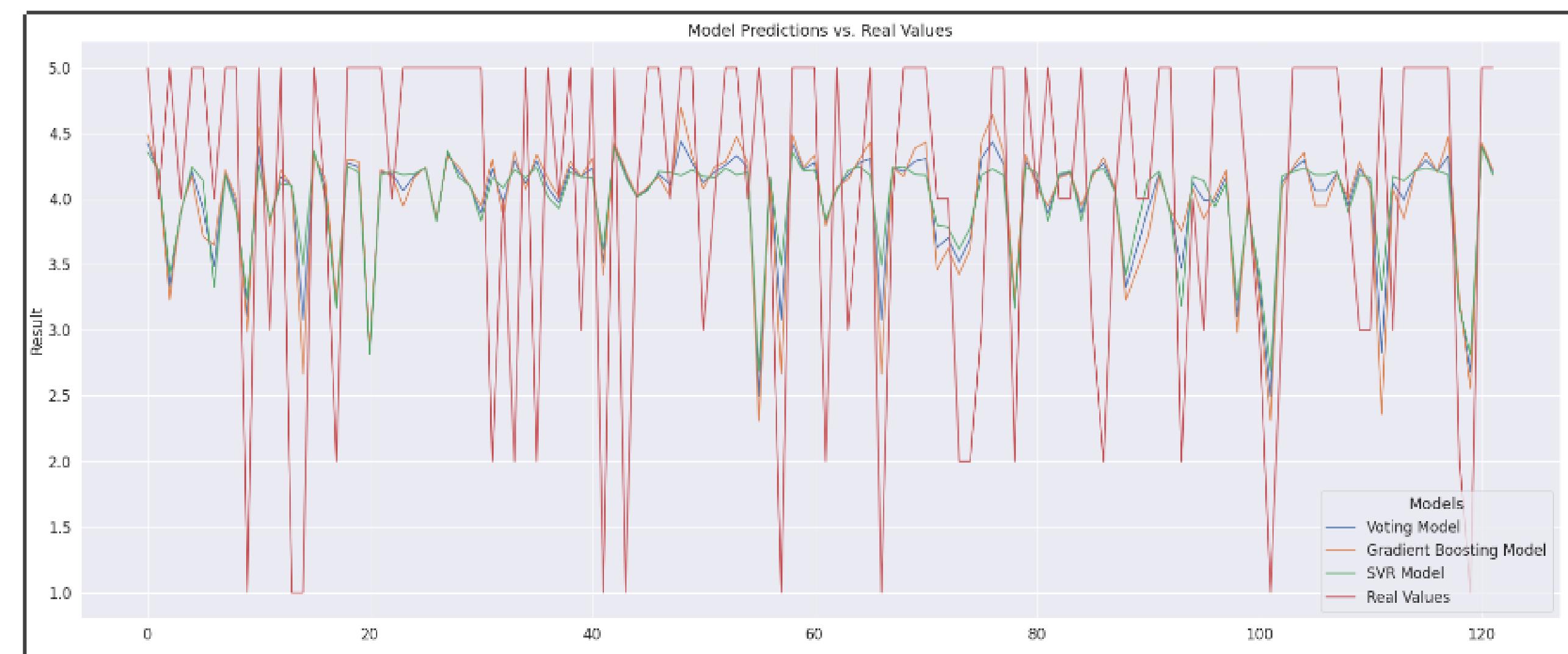
Hyper Parameter Tuning and Ensemble Model

ALGORITHM IMPROVEMENT

SVM	0.019
GB	0.003
KNN	0.006



Algorithm	RMSE Score
Ensemble Model	0.988

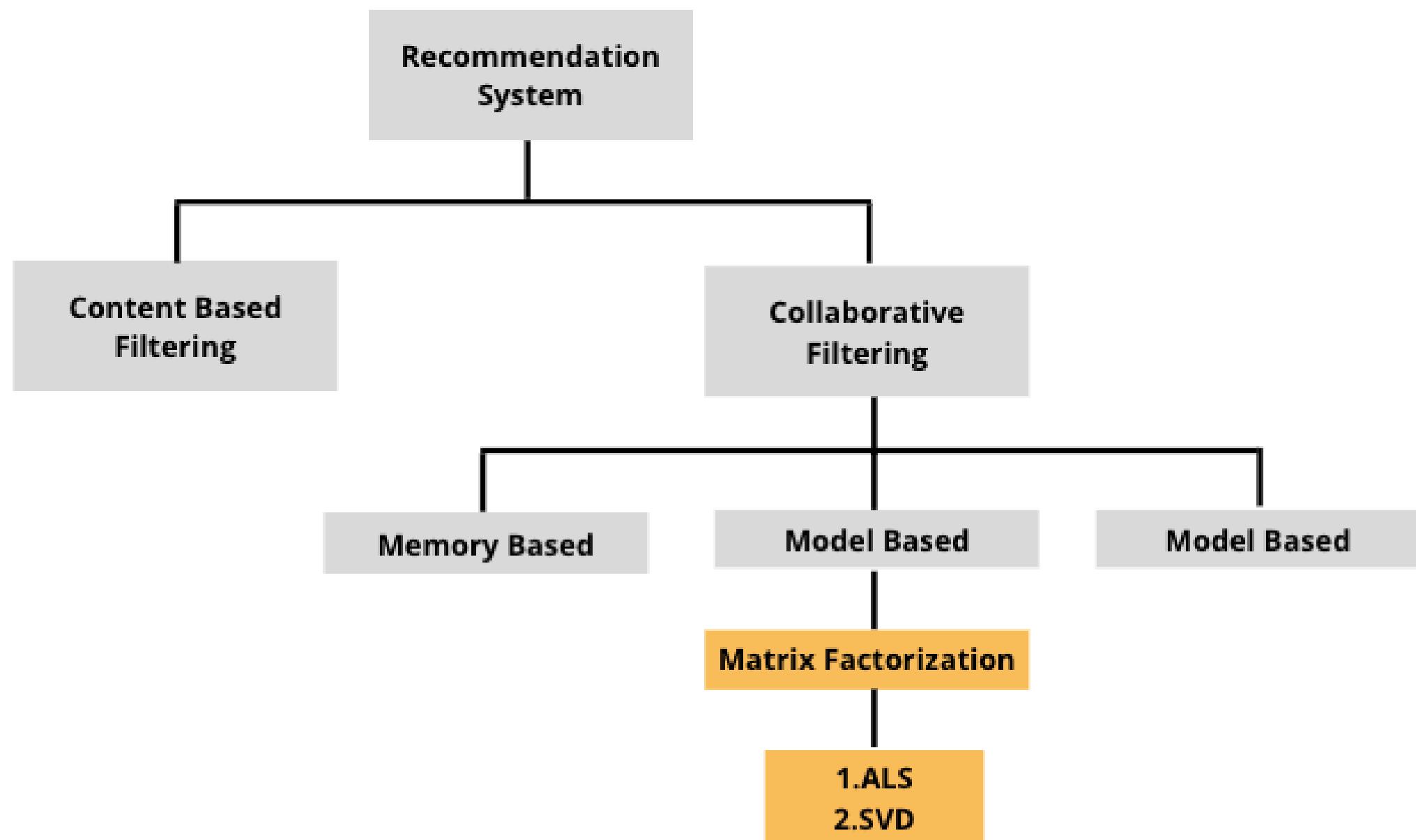


...

Recomendation System



Recommendation System

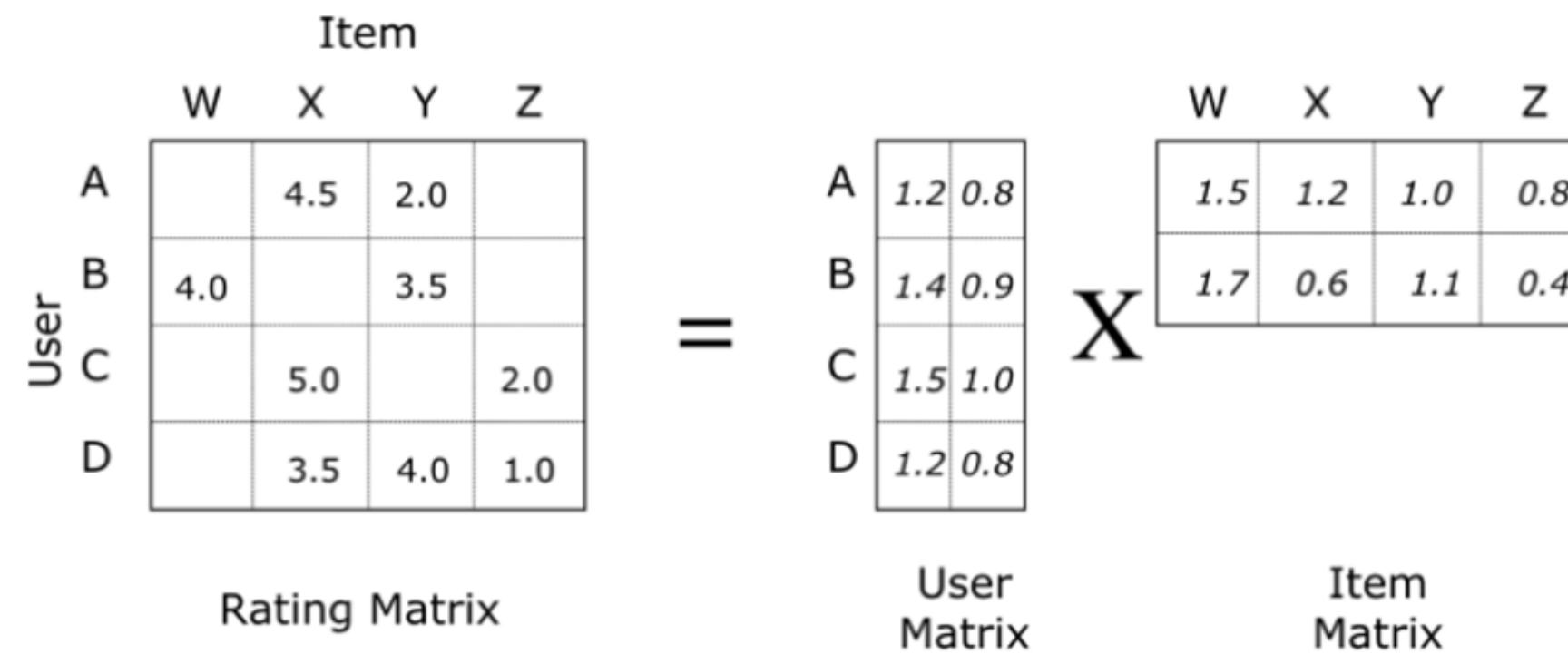


- Collaborative filtering can help users discover new interests
- Matrix factorization just requires users feedback
- Dataset with a sparsity of 80%
- Scalable system





Matrix factorization



METHODS

✎ Alternating Least Squares (ALS).

✎ Singular Value Decomposition (SVD)

METRIC

▀ Mean Absolute Error



...

Machine Learning Ops.

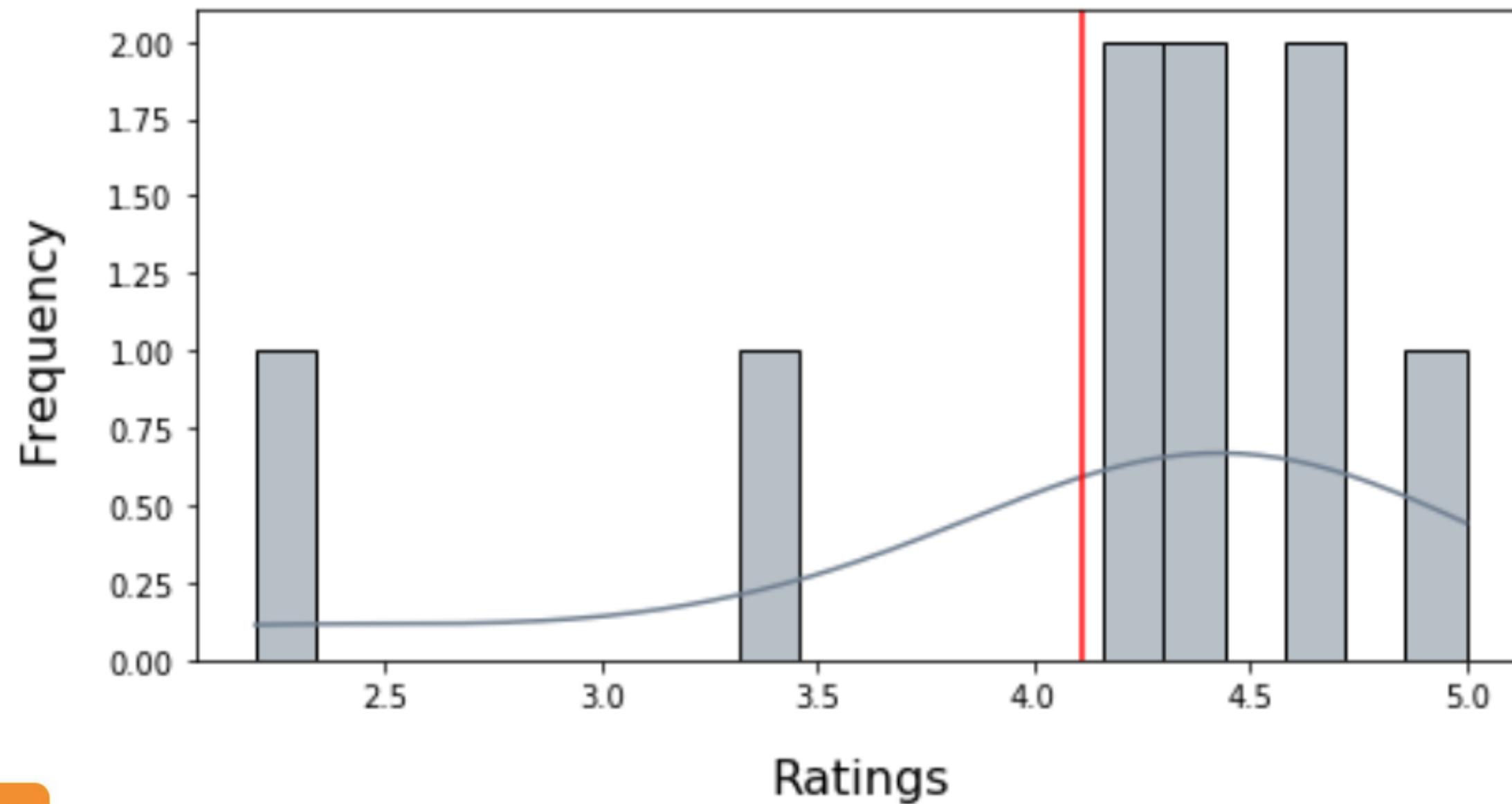


A/B Testing

...

ALS Collaborative Based Filtering

Our users are **happier** by 0.30!



Avg. user happiness



4.1

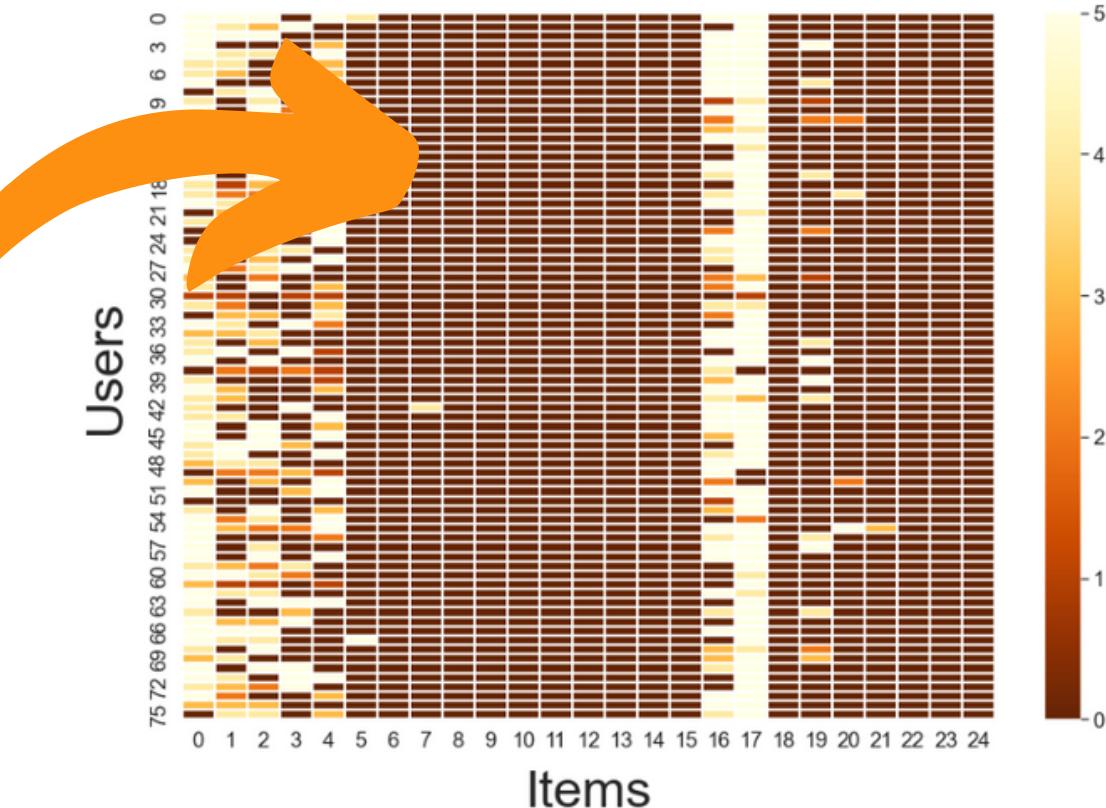




Hybrid Method

- Solving the Sparsity Problem
- Combining Content-based and Collaborative Filtering

Matrix Factorization



...

Next Steps



Next Steps



1

DATA COLLECTION IMPROVEMENTS

2

MODEL IMPORVEMENT & SCALABILITY

3

PRODUCT VISION (MOCK-UP)



...

Data Collection Improvements



USERS

- Demographic Variety
 - User information
-

PLACES

- # of POIs
- POI features



...

Model Improvement & Scalability



IMPROVEMENT

- More users
- Hybrid model

SCALABILITY

- More user profile and habits data points



...

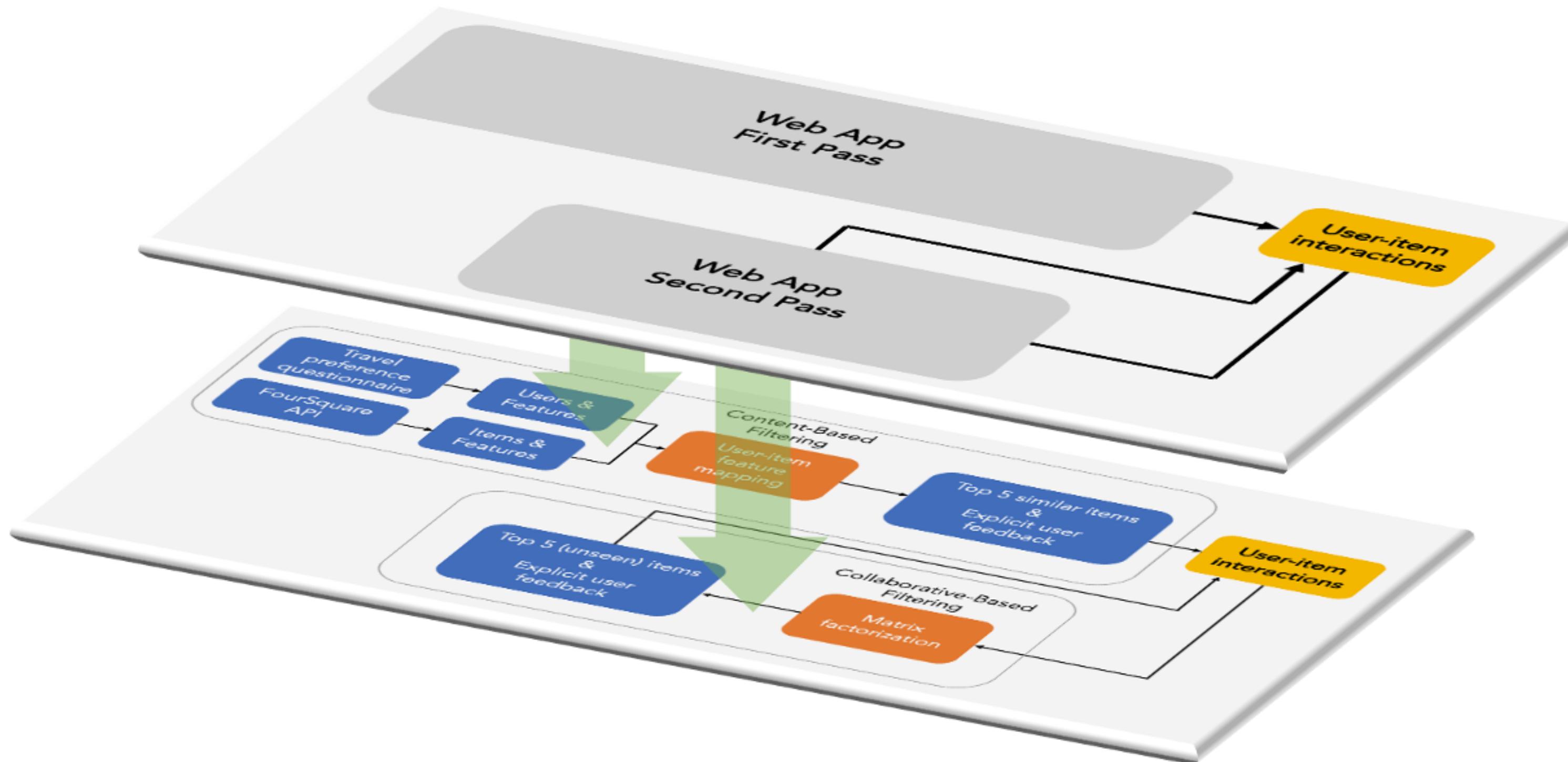
Our first mock-up...



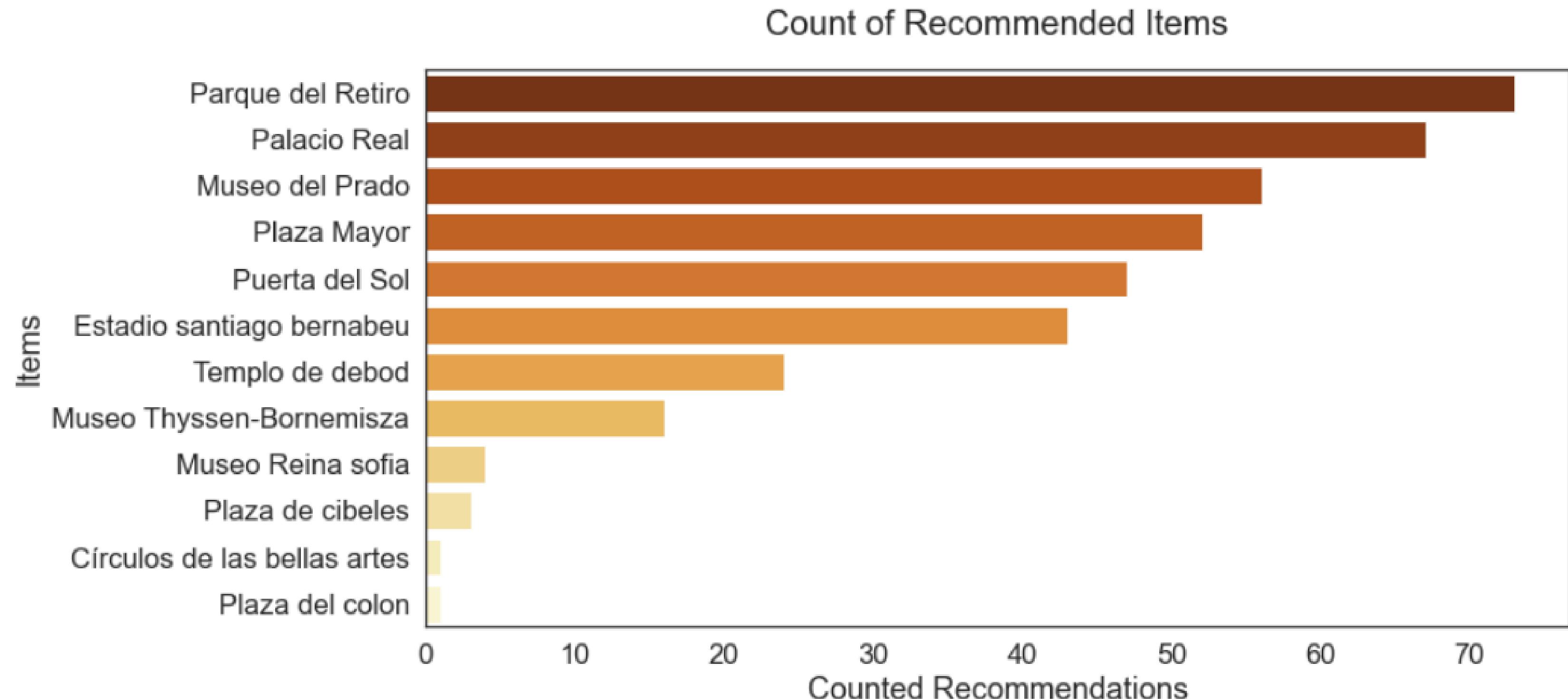
Thank you!

Daniel Chacón Rodriguez
Ignacio Gonzalez Granero
Alexander Wolfgang Humpert
Manuel Hupperich
Tamara Samaha
Thomas August Maria Stenger

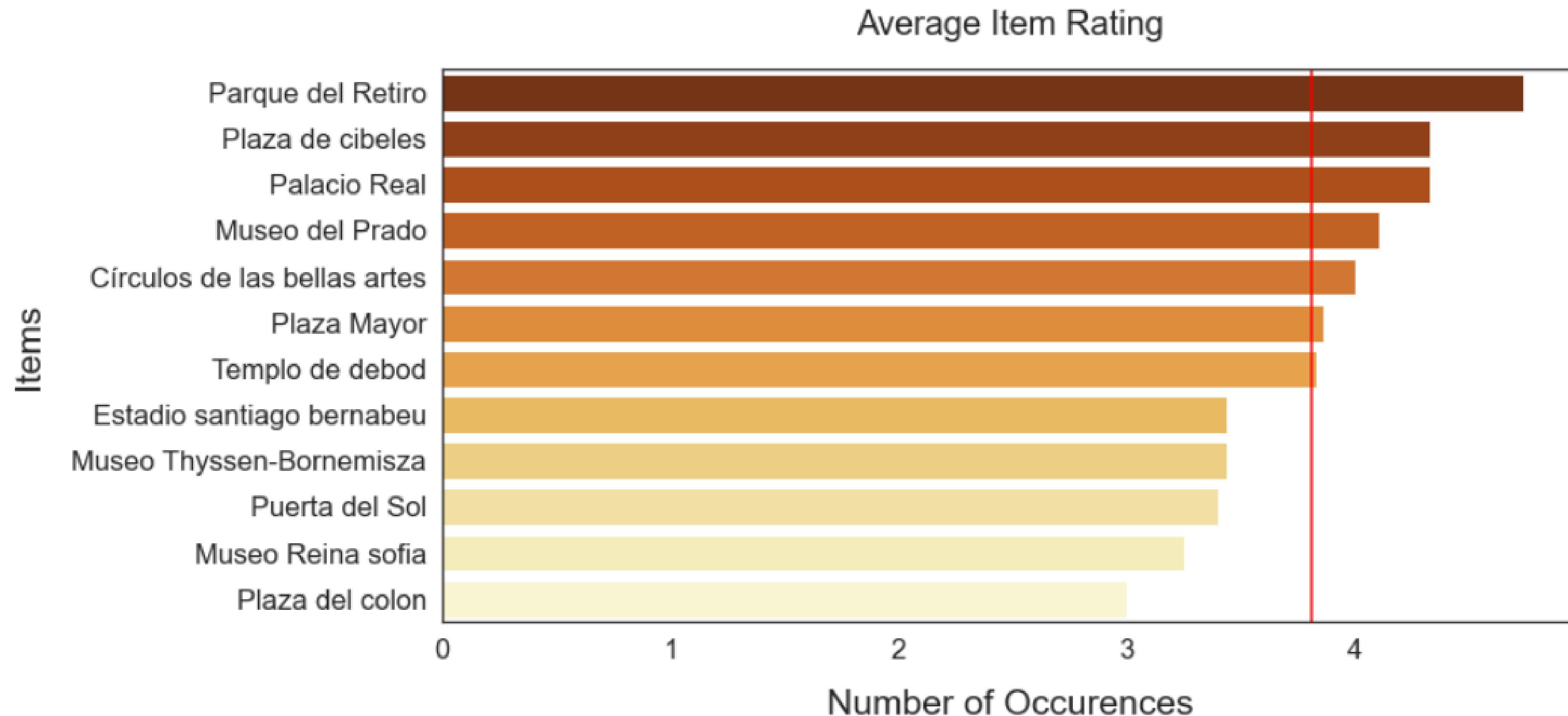
Appendix 1: Overlay of web app over recommendation system architecture



Appendix 2: Bar chart of count of recommended items from content-based recommender



Appendix 3: Bar chart of average item of recommended items from content-based recommender

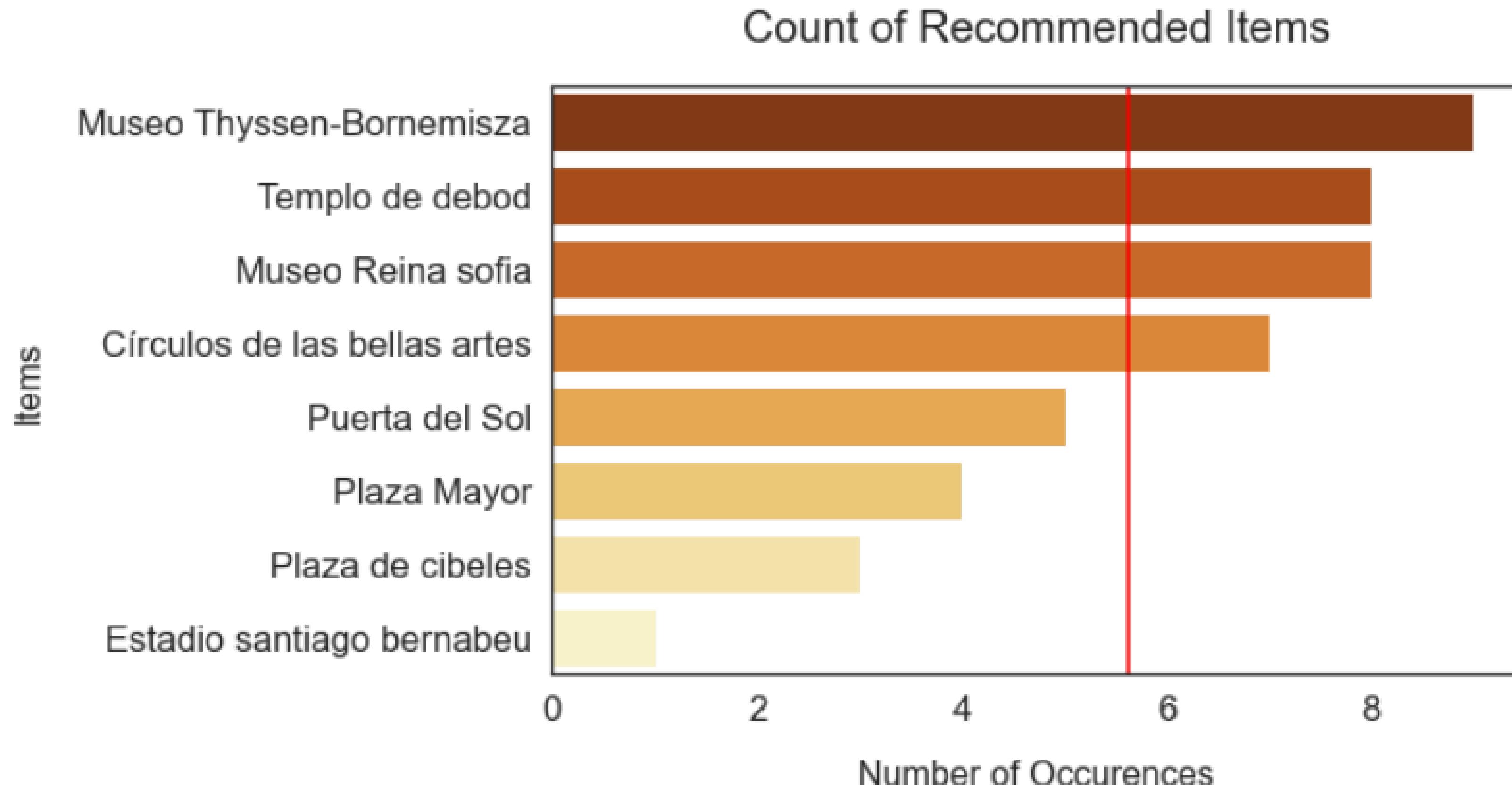


Appendix 4: Wordcloud of user comments

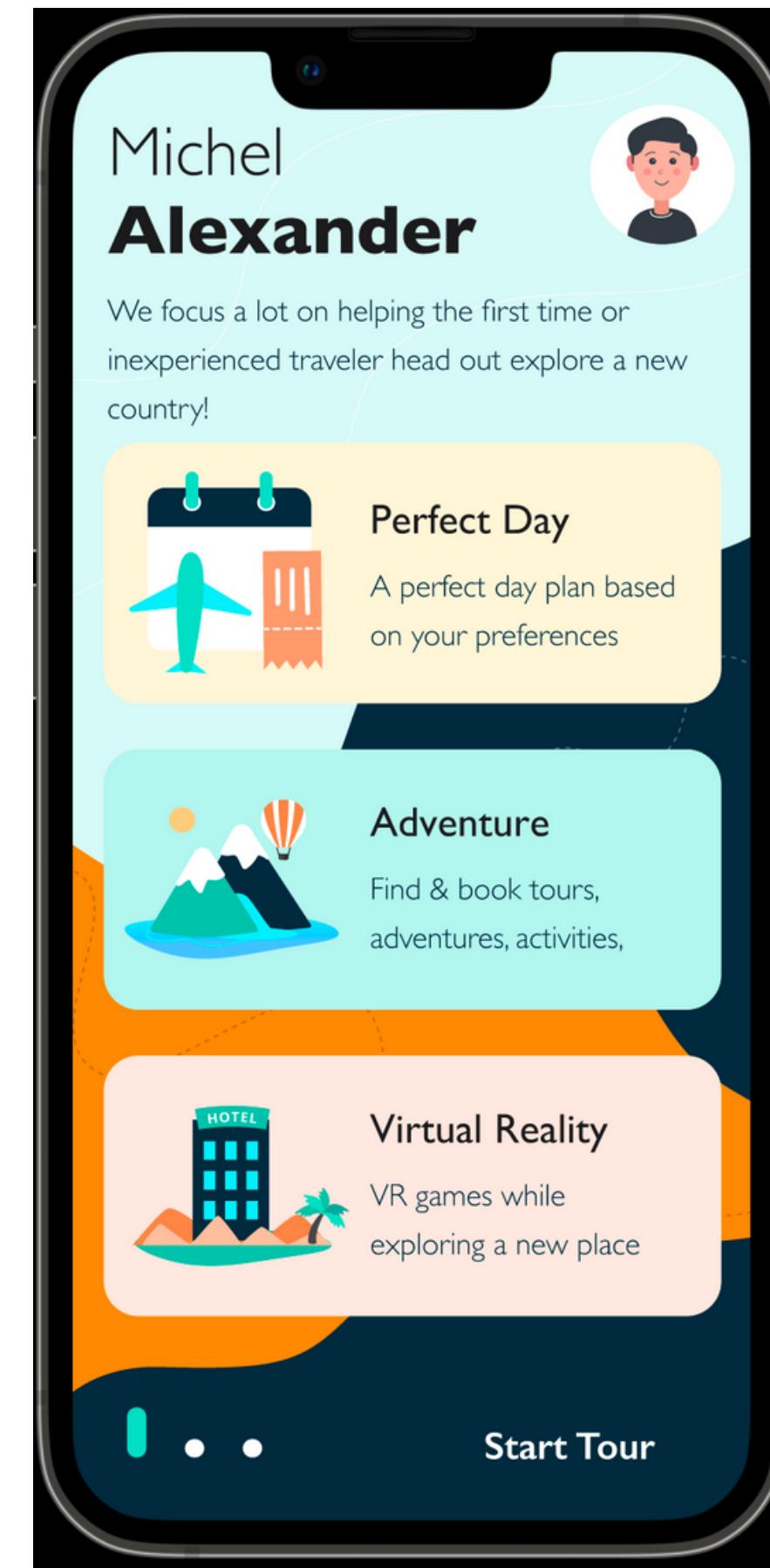
User Comments



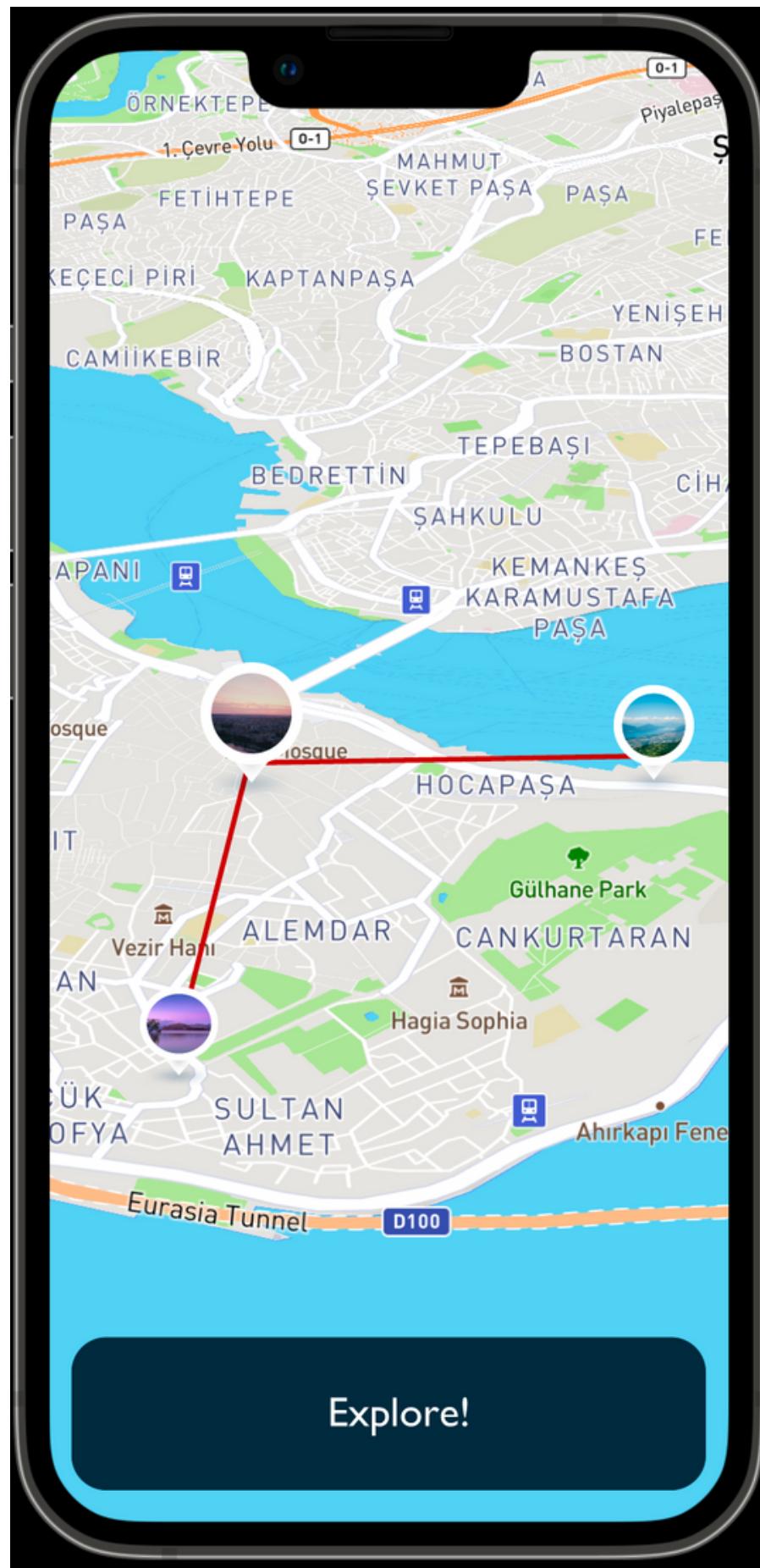
Appendix 5: Bar chart of count of recommended items from collaborative-based recommender



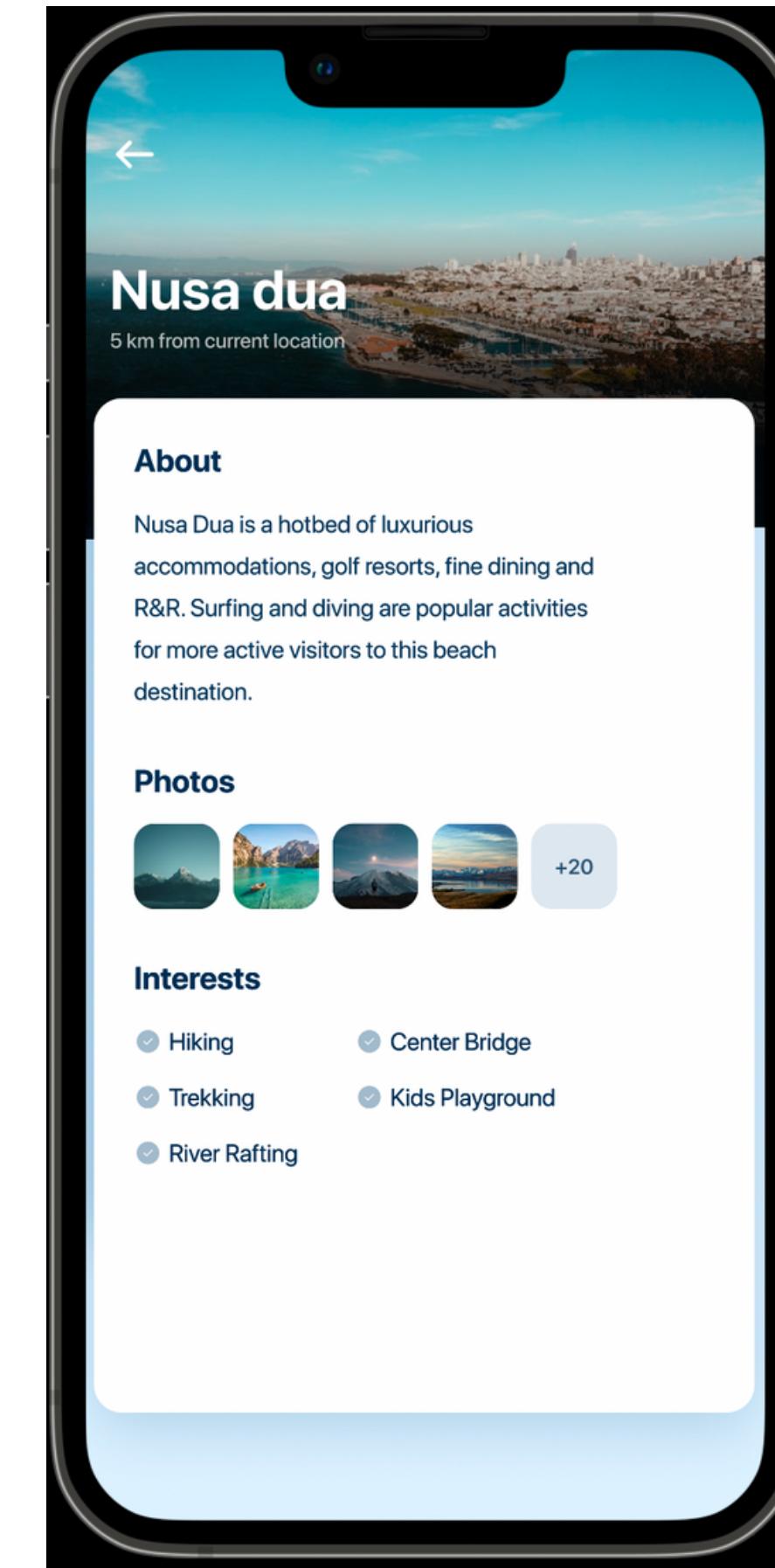
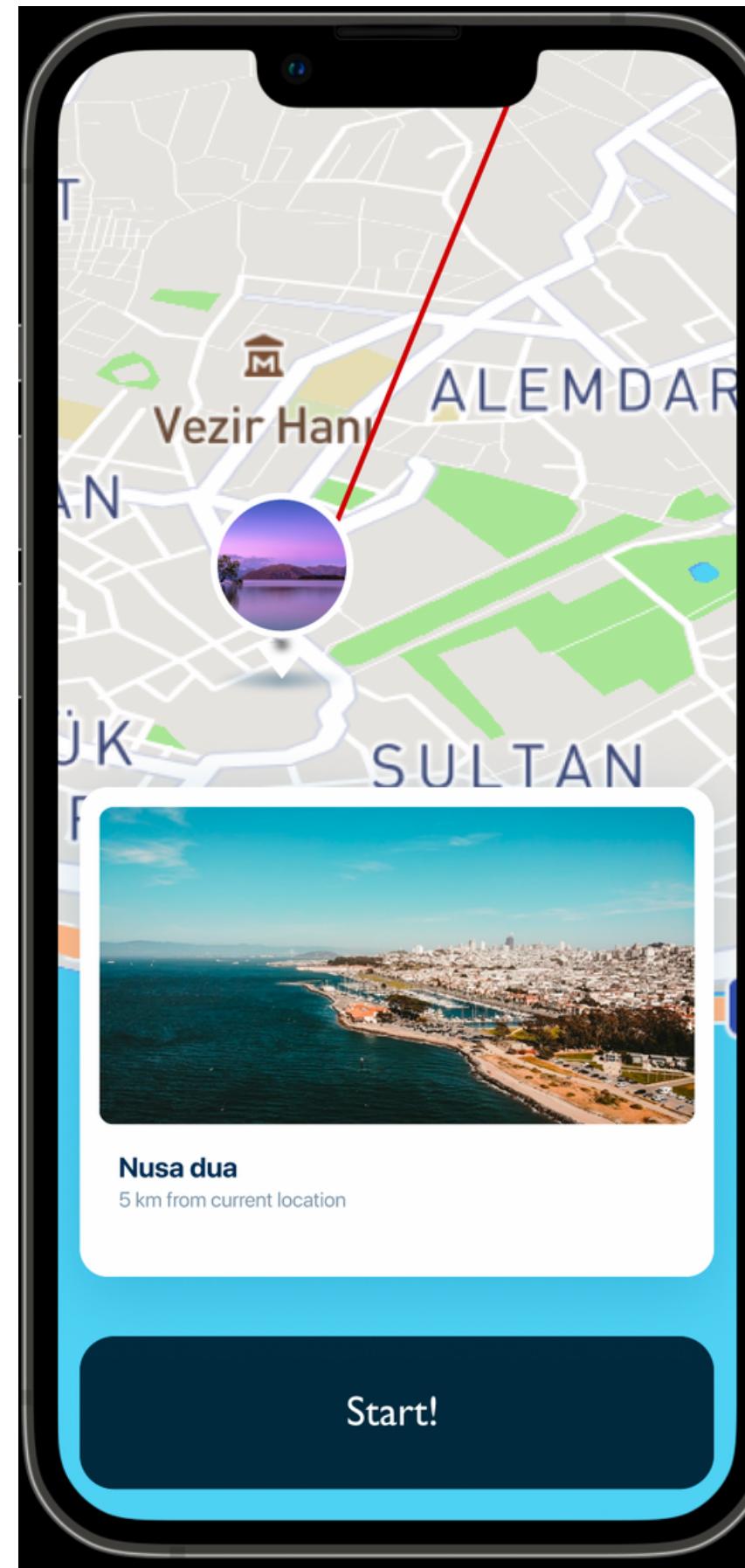
Appendix 6: Login and landing pages



Appendix 7: Customized Route



Appendix 8: Point of interest "about" pages



Appendix 9: Route ratings page

