

Blissful Borders

A Personalized City Recommender System for Optimizing Happiness

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Introduction

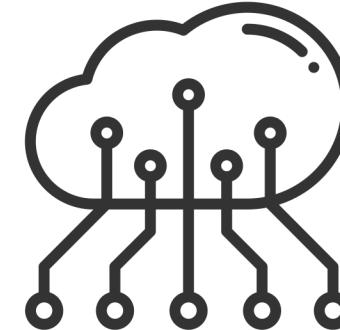


Challenge: As migration becomes more feasible and remote work rises, choosing the ideal city to live in has become part of pursuing happiness. Even with abundant data about different locations, choosing a place to live is a difficult task.



Objective: To address this problem, an AI-powered app will leverage the user's demographic and social profile to identify the city that will maximize their well-being by meeting their socio-economic and environmental needs. Recommendations are provided in user-friendly, map based application that acts as a world data explorer tool.

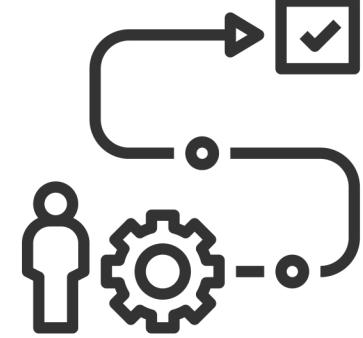
Data



Variables were selected based on empirical evidence of the determinants of human well-being. Data from seven separate data sources was combined to construct a database containing 43,855 total records. Our recommender uses the following features:

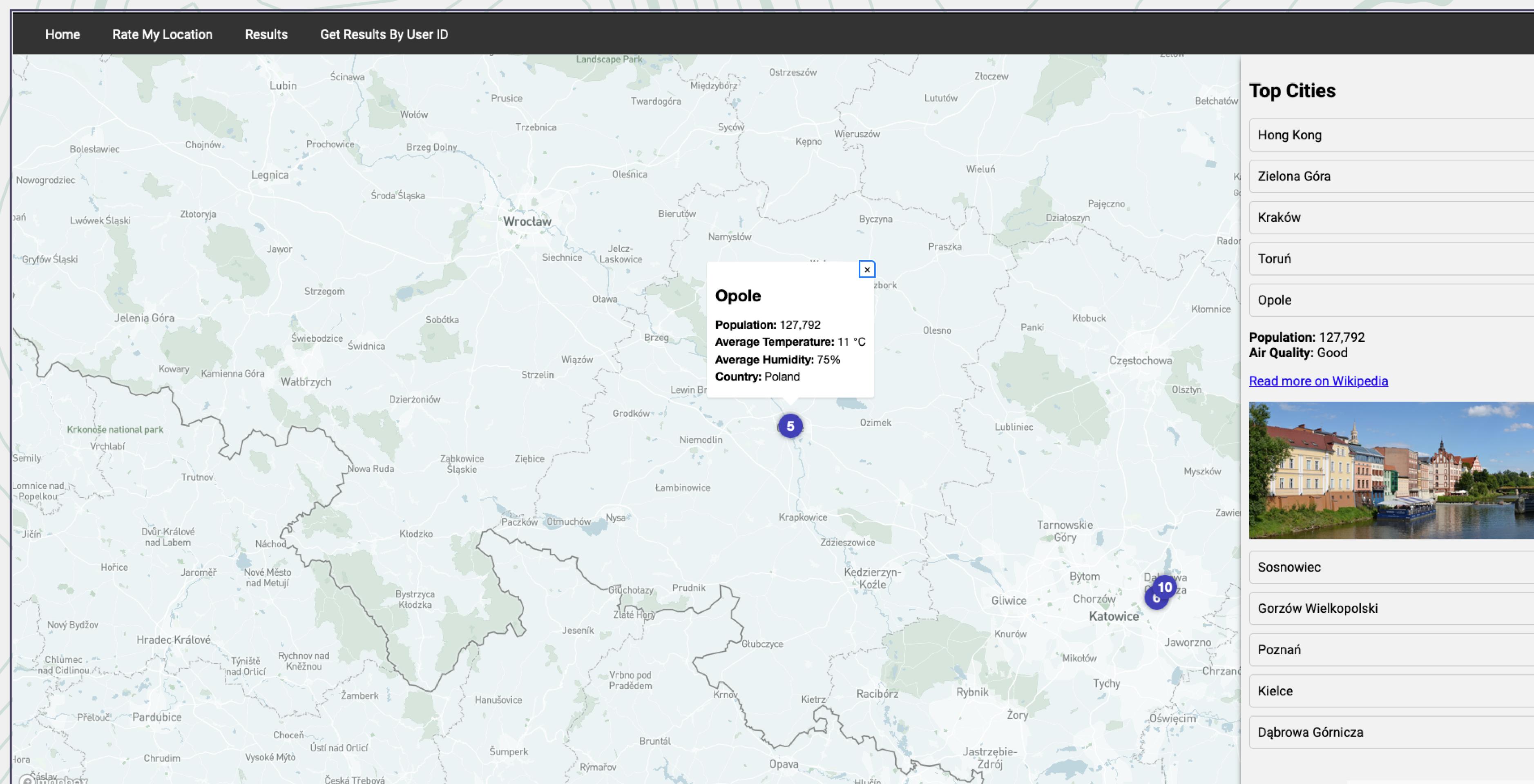
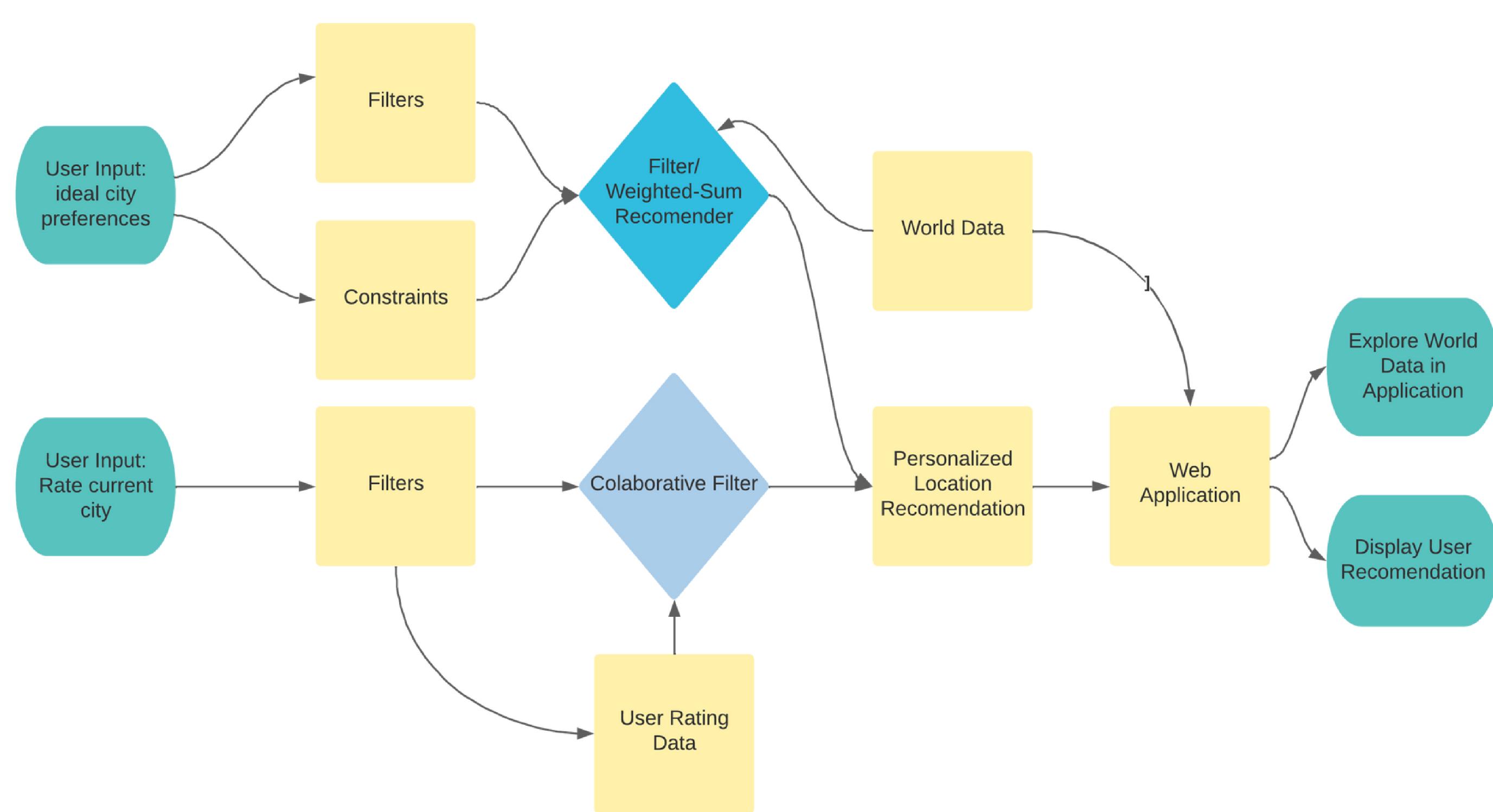
- World Happiness Index, (World Happiness Report, 2023)
- GDP per capita, (World Happiness Report, 2023)
- Women's peace and security index (WPS Index Report 2021–2022)
- Freedom for LGBTQ+ individuals (Ferguson, et al 2019)
- Climate type (World Climate Data, 2023)
- Predominant industry (CIA World Factbook, 2021)
- Air quality PM 2.5 (SEDAC- NASA, 2016)
- City population size (Simple Maps, 2022)

Method

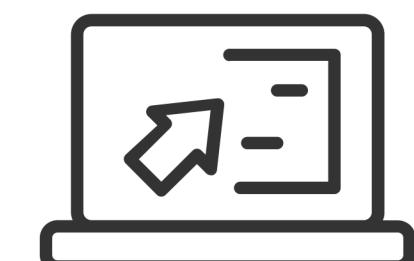


Our application uses two approaches. The first is a **hybrid filtering/weighted sum optimization** algorithm, which takes user preferences for categorical and continuous variables as input and optimizes for the world happiness index to return optimal locations.

The second is a **item-based, collaborative filtering recommender system**, which demonstrates how this application could be deployed at scale and recommendations be improved by user data. For demonstration the recommender was trained using a simulated data set. The simulated data set was generated by our team by randomizing preferences to create users, generating rank values on randomly selected cities with our hybrid filtering/weighted-sum recommender. The recommender uses cosine similarity scores to predict the optimal city for a user.



The App



The system uses Flask, a web framework, to manage HTTP requests and responses, web page templating in HTML, and integration with JavaScript visualization libraries, providing a seamless user experience. Users can input their desired location characteristics through a form, receive recommendations generated by the weighted sum algorithm, and explore the recommendations on a map constructed using the Mapbox JavaScript library.

Experiments and Results



Several techniques were explored to produce recommendations that were both constrained by the users' preferences and optimize World Happiness Index values with various results. Ultimately the filter/weighted-sum approach was best for static data and the collaborative filtering algorithm was best for scaled use of the application that could continually improve based on user ratings.



The high accuracy of the model suggests the recommender will work well at scale. The **RMSE of the recommender's performance on the simulated training set is .91 and .76 on the test set.**

	Multiple Objective Data Filter	Linear Programming with various solvers	Multi-Objective Optimization	Filter/Weighted-Sum	Collaborative Filtering
Yields a feasible solution on all test case				✓	
Scales to large data set	✓				✓
Can be trained on user data				✓	✓