Airbnb during COVID-19: An Improved Lodging Planner

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Introduction

Airbnb's operation has been affected by the outbreak of COVID-19 due to increasing concerns on health and safety for travelling and lodging. Using Austin as a test case, this project aims at improving Airbnb's user features by providing more current related information such as the forecast COVID-19 cases and the statistic relating to safety like the crime rate on the lodging neighbors for holiday seasons of 2020.

Motivation

Nowadays travelers are spending tremendous amount of time on researching the spread of COVID-19, the location, safety and price of lodging for their destinations since currently these information are all fragmented and dispersed in the internet. While Airbnb posts their latest response to COVID-19, it provides no specific information relating to the virus's geographical distribution and its trend. Other information about crime activity, population density and so on are also rarely found in the official website. Integrated information is on demand to help customers visualize the potential risks on traveling.

Approaches

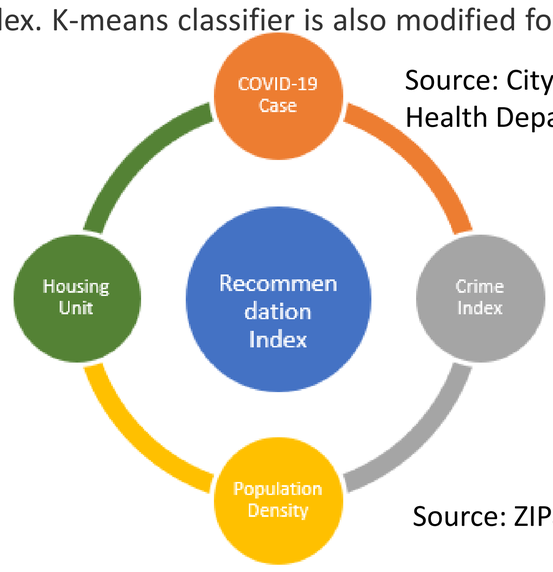
- **Integrated information for one-stop shopping:** targeting both the travelers and the hosts (property owners) as users, the project adds case-specific features such as the statistics of COVID-19, predictions of trend and recommendation index to the existing Airbnb rental site to help users make informed decisions and adjust plans/strategies accordingly.
- **Interactive map and charts to visualize information:** An interactive user interface is created where users can visualize either the risk of COVID-19 or the ultimate recommendation index for each neighborhood. The interface also provides details on the predicted trend of COVID-19 and other helpful information including the pricing, availability and safety.
- **ML algos workflow:** Time-series ARIMA model is first used to forecast the number of COVID-19 cases in the upcoming days. The prediction results are subsequently fed into the classification model to predict the "risk" (recommendation index) of the Austin area.
- **Apply unsupervised ML to decide on "risk":** Instead of using COVID-19 cases as the sole measure, unsupervised Machine Learning model (clustering) incorporates several different factors to predict the recommendation index. K-means classifier is also modified for a smoother predicted result.

Data

Source: City of Austin, Public Health Department

Source: City of Austin

Source: Austin police department



Source: ZIPatlas

Figure. Four Factors Matrix

Survey

Team members ask their friends and family to be the focus group for. The team created a survey contained 9 questions regarding the new features and interface design conducted. Some of the feedbacks are as follows:

6. What particular aspect(s) of our website do you like?	7. What particular aspect(s) of our website do you dislike?
Everything seems perfect!	None; It is perfect!!! I absolutely love it. It's amazing!!!
The prediction and visualization are very informative. This helps ...	It would be great if the website can work for other parts of the U.S
The content is very relevant this year.	It will be even more helpful if there are more cities are included in this website.
The visualization is very nice and the information is helpful.	The Covid trend doese not explain where the prediction is coming from.

Experiments and results

- ARIMA: COVID-19 cases time series prediction

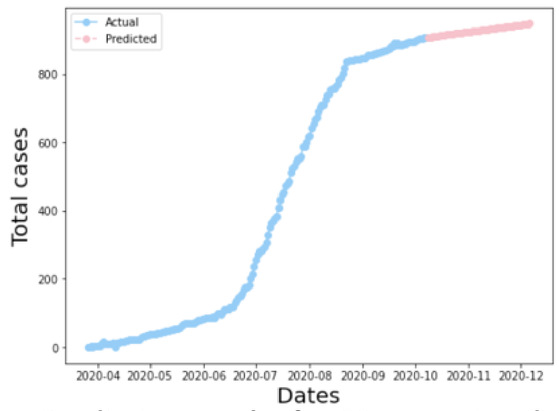


Figure. Prediction results for 60 upcoming days for zip 78653

- k-means clustering: Recommendation index classification

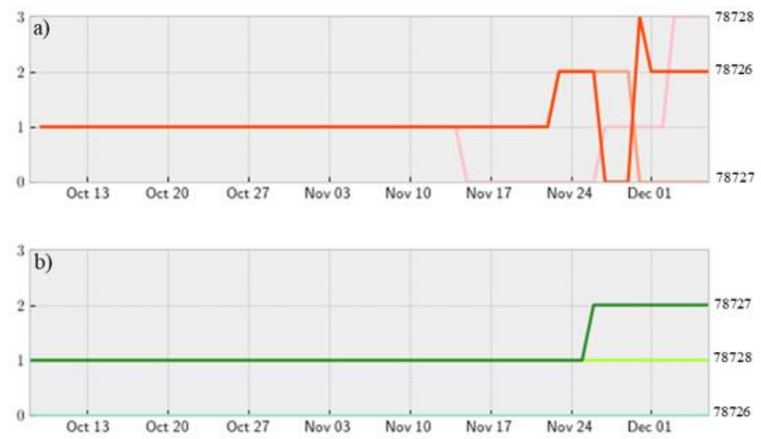


Figure. a) Jump in "Risk scores" curves in K-means;
b) smoother "Risk scores" curves in modified K-means

Users can select their destinations and check-in dates to search for available lodging. The main body is a map of Austin Area. Users can choose visualizing the neighborhoods color-coded in two ways, either by the number of COVID-19 positive cases or by Recommendation Index. Each Airbnb property is pinned on the map. Its details are shown on the bottom-right section when the user clicks to the pinned point. On the other hand, users can mouseover the specific neighborhood for its statistic shown in the tooltip. Comparison between the neighborhood versus the overall Austin area is presenting on the right. Lastly, the web app contains graphs where users can check the trend of their future travelling days or the historical data on COVID-19 cases.

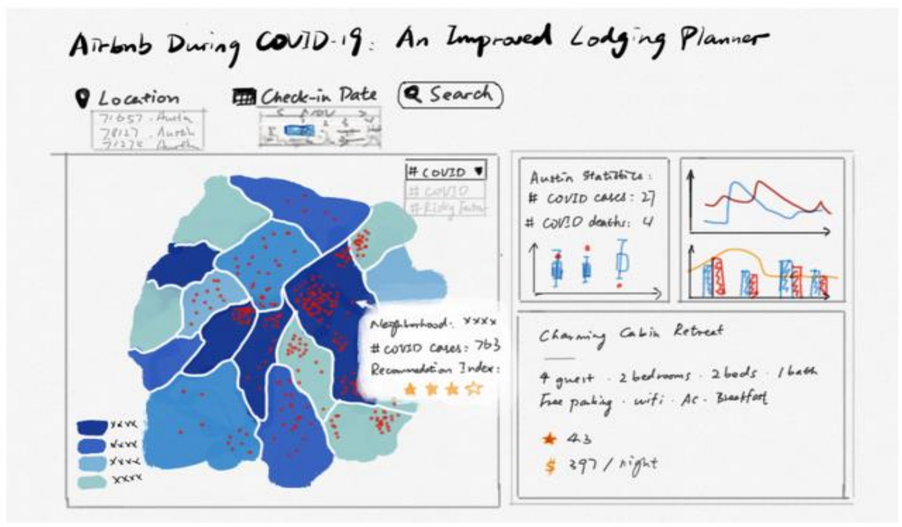


Figure. Web Interface Sketch

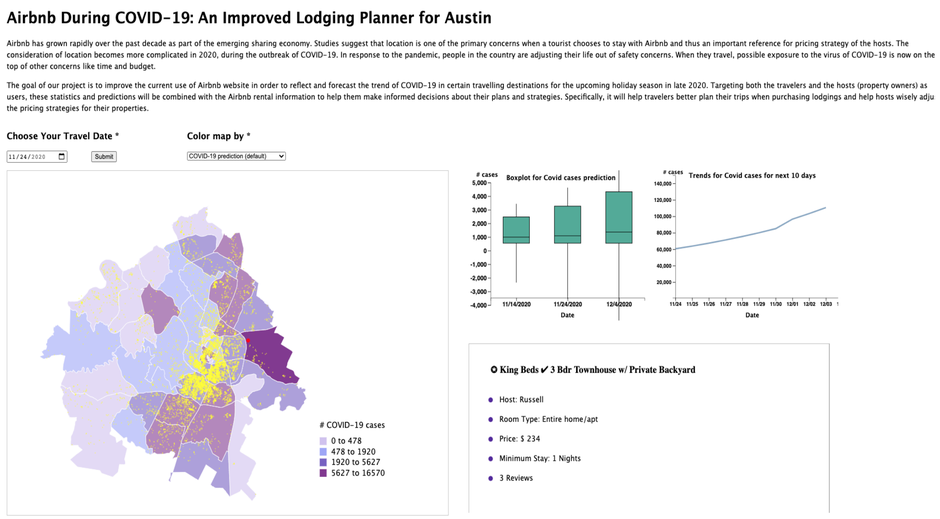


Figure. Final Interface Sketch