Group 12's Investor Report for AirBnB's in San Diego

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01 Kaggle Overview

1. Cleaning

Handling of missing values. Numeric values were replaced with median of the particular column.

2. Feature Selection

We applied domain knowledge,used feature selection models and visualizations to understand the significant variables and dropped 37 redundant variables.

3. Modeling

We started with basic linear and logistic models and slowly moved onto ensemble methods.

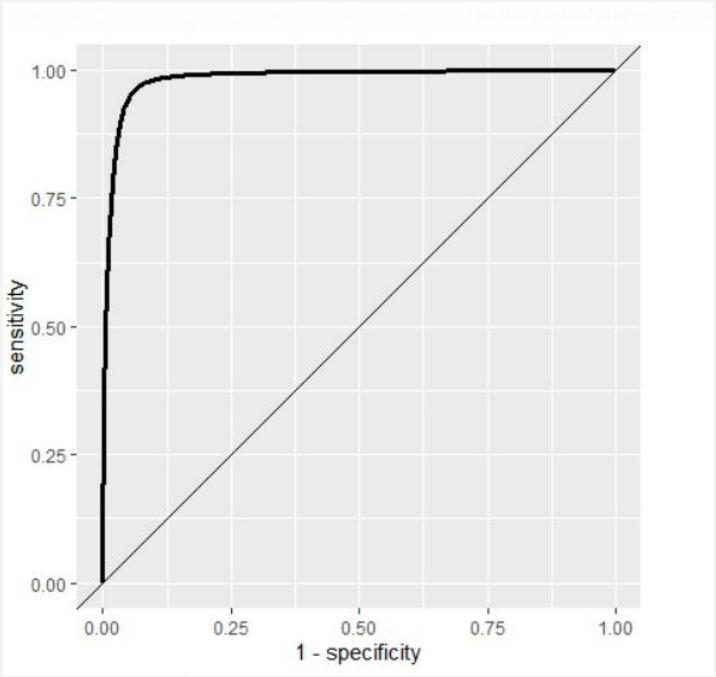
4. Conclusion

Our final model is the XGBoost model with 29 variables which gave us an accuracy of 84% and roc estimate of 0.91

.metric <chr>	.estimator <chr>	.estimate <dbl>
roc_auc	binary	0.913636

1 row

```
Confusion Matrix and Statistics

             high_booking_rate
predictedClass     0     1
             0 19517  2483
             1  2350  5968

               Accuracy : 0.8406
                 95% CI : (0.8364, 0.8447)
    No Information Rate : 0.7213
    P-Value [Acc > NIR] : <2e-16

                  Kappa : 0.6016

 Mcnemar's Test P-Value : 0.0576

            Sensitivity : 0.7062
            Specificity : 0.8925
         Pos Pred Value : 0.7175
         Neg Pred Value : 0.8871
             Prevalence : 0.2787
         Detection Rate : 0.1968
   Detection Prevalence : 0.2744
      Balanced Accuracy : 0.7994

       'Positive' Class : 1
```



02 Business Requirements

Develop a business case for an investor who is interested in acquiring homes in San Diego to put them up as AirBnB rentals.

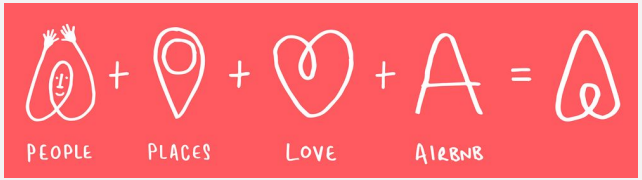
Project Statement

Requirement 1

Investor aims to purchase those properties which yield high airbnb traffic.

Requirement 3

Investor needs to provide the amenities which result high airbnb traffic.



Requirement 2

Investor needs to strategize how to advertise the property for airbnb rentals based on different variables.

Market Analysis: San Diego

03

Tourism

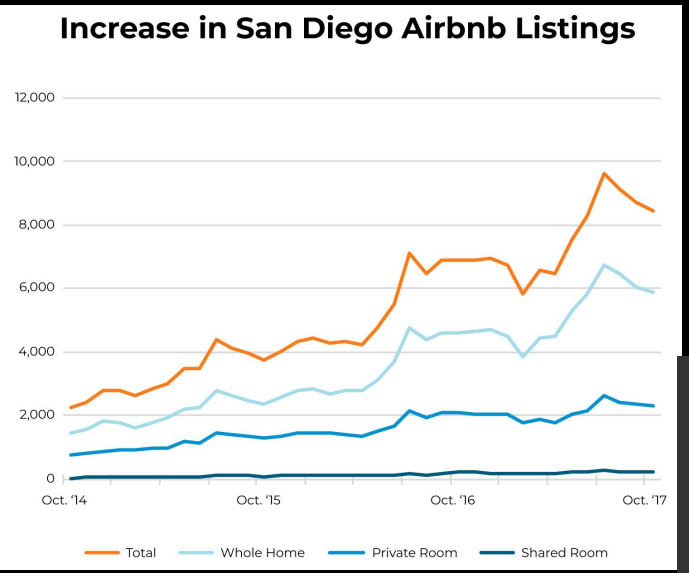
Popular Events

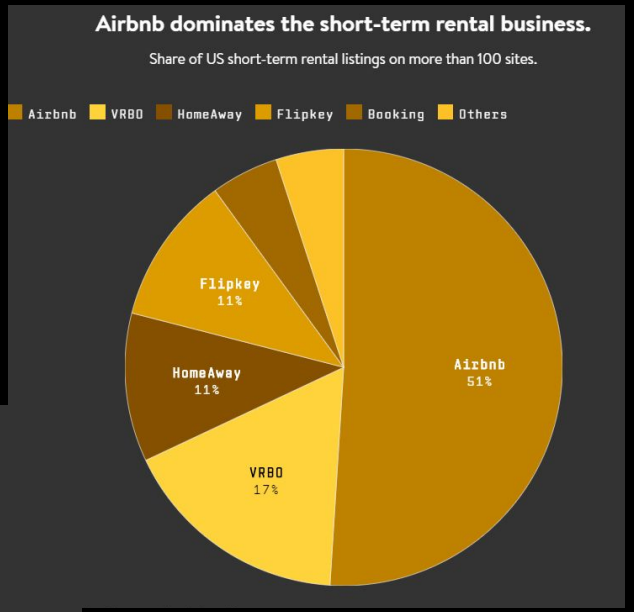
- SAN DIEGO COMIC-CON
- SAN DIEGO COUNTY FAIR
- MIRAMAR AIR SHOW
- KAABOO DEL MAR

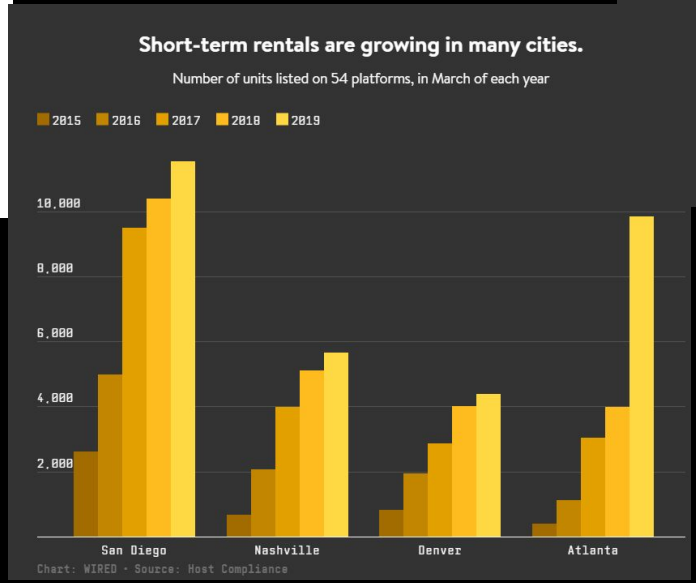
Popular Attractions

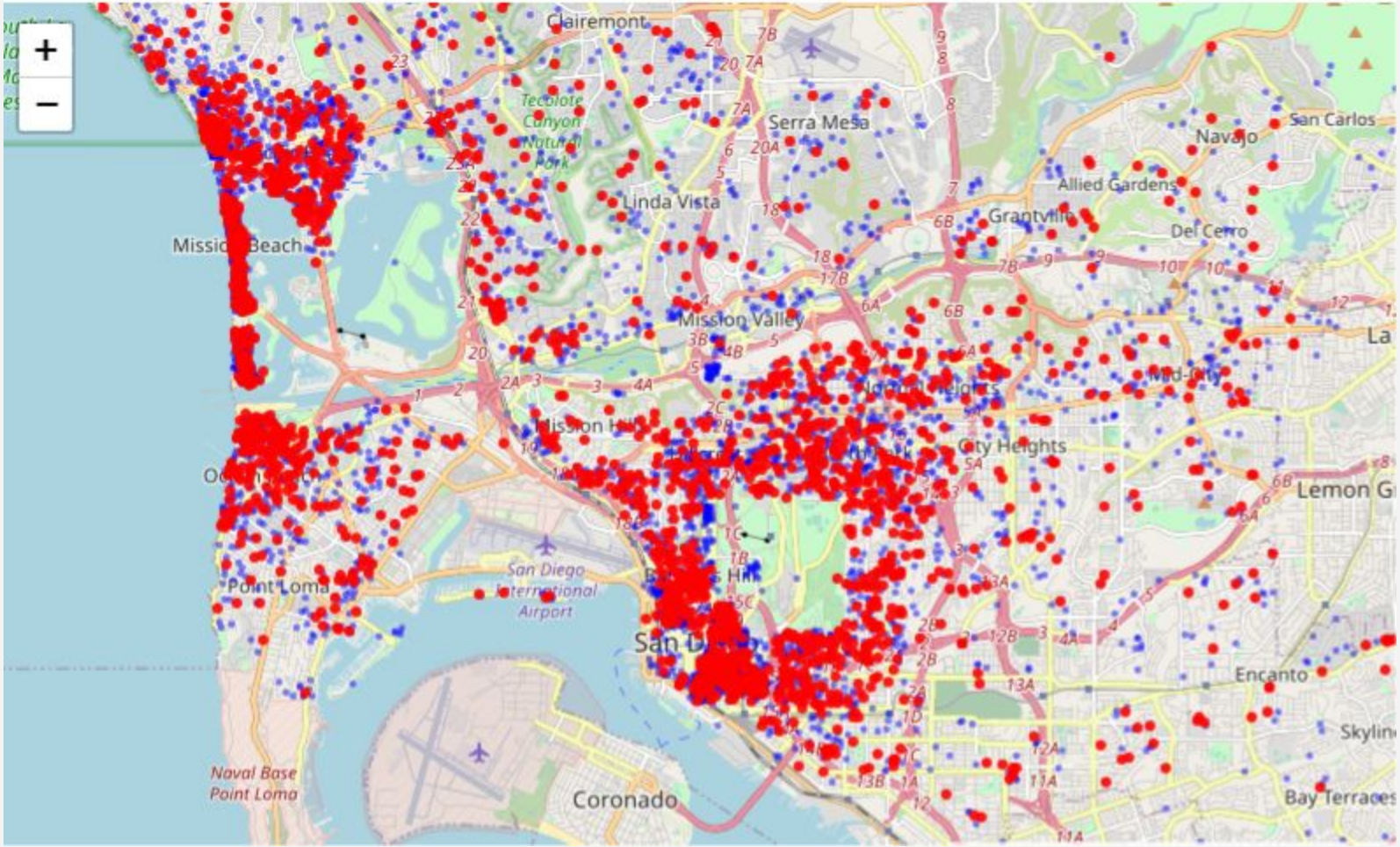
- LEGOLAND
- San Diego Zoo
- Balboa Park
- Sea World

Market Data Analysis

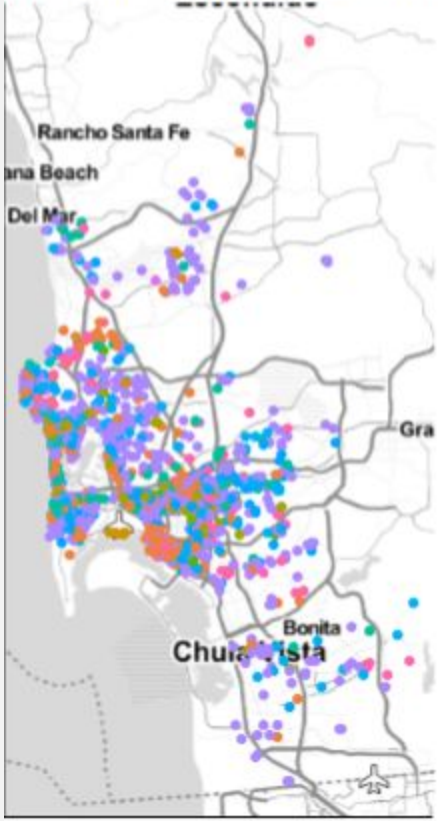







Clairemont
Tecolote Canyon Natural Park
Serra Mesa
Navajo
San Carlos
Allied Gardens
Linda Vista
Grantville
Del Cerro
Mission Beach
Mission Valley
City Heights
Point Loma
San Diego International Airport
Encanto
Naval Base Point Loma
Coronado
Bay Terraces

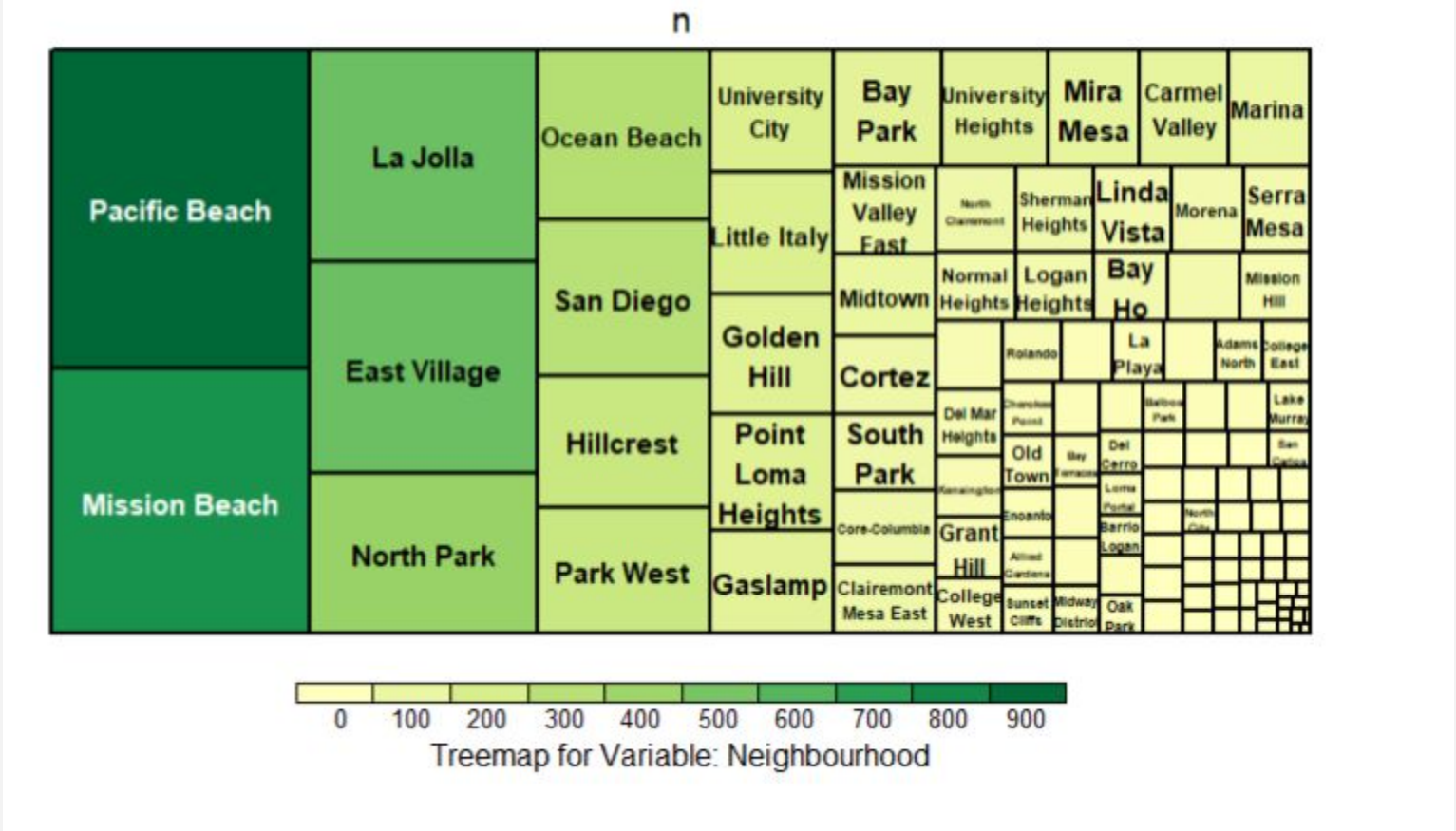
Properties with high_booking_rate=1



property_type

- Aparthotel
- Apartment
- Bed and breakfast
- Boat
- Boutique hotel
- Bungalow
- Cabin
- Camper/RV
- Casa particular (Cuba)
- Cave
- Chalet
- Condominium
- Cottage
- Dome house
- Farm stay
- Guest suite
- Guesthouse
- Hostel
- House
- Loft
- Other
- Serviced apartment
- Tiny house
- Townhouse
- Villa

Tree Map

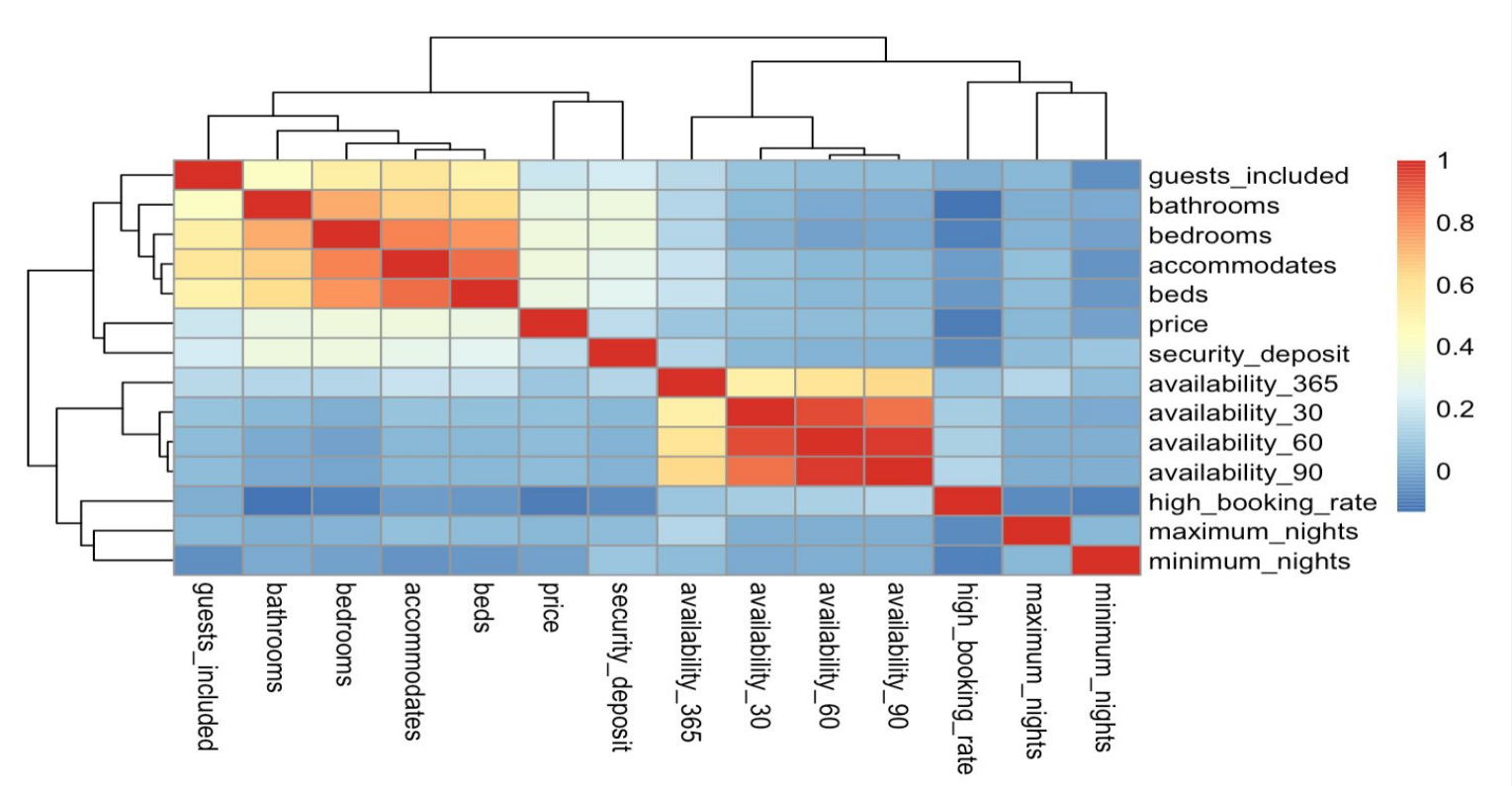

n
Pacific Beach
La Jolla
Ocean Beach
University City
Bay Park
University Heights
Mira Mesa
Carmel Valley
Marina
Mission Valley East
Linda Vista
Morena
Serra Mesa
Little Italy
Sherman Heights
San Diego
Midtown
Normal Heights
Logan Heights
Bay Ho
Mission Hill
Golden Hill
Rolando
La Playa
Adams North
College East
East Village
Cortez
Lake Murray
Del Mar Heights
Point Loma Heights
Hillcrest
South Park
Old Town
Del Cerro
Enoanto
Barrio Logan
Core-Columbia
Grant Hill
Mission Beach
North Park
Park West
Gaslamp
Clairemont Mesa East
College West
Sunset Cliffs
Midway District
Oak Park
0
100
200
300
400
500
600
700
800
900
Treemap for Variable: Neighbourhood

04 Business Cases

Business Case 1

Can the price alone determine the High Booking rates?

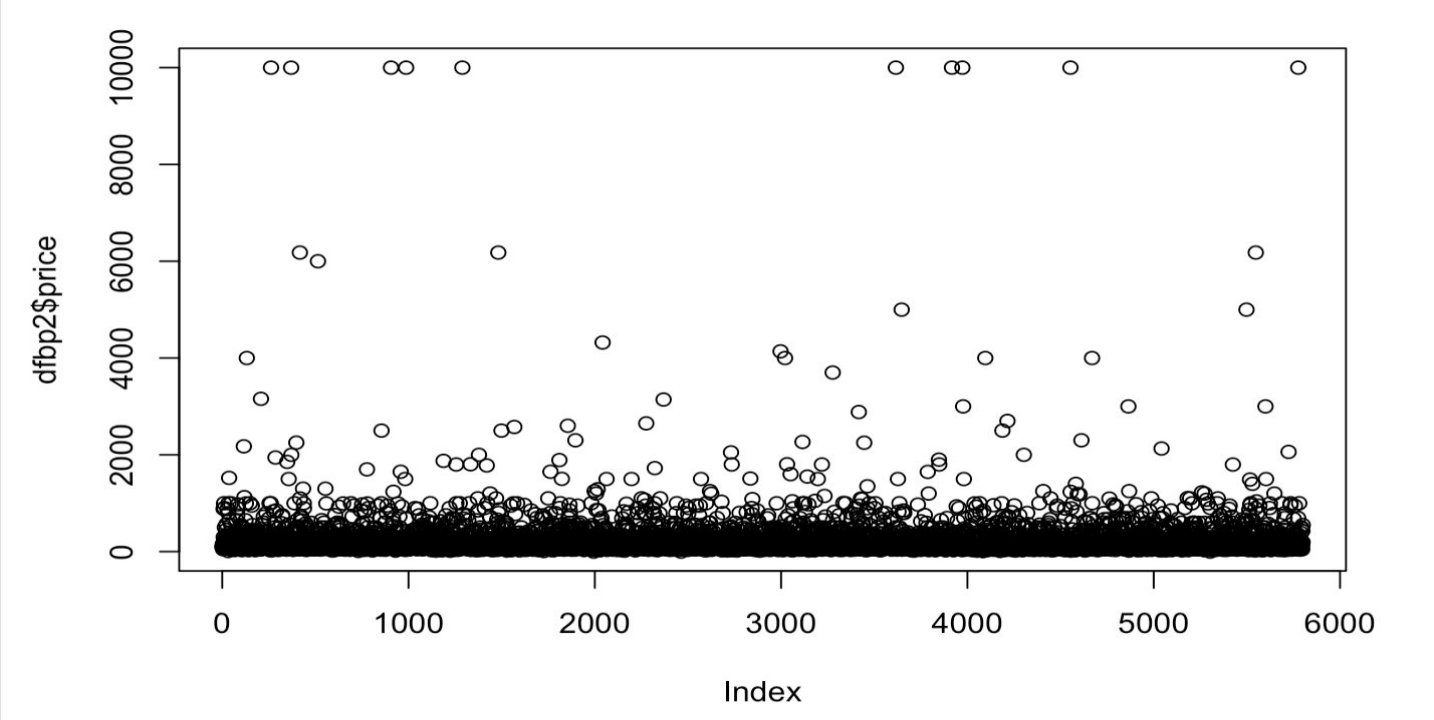
To Focus on Marketing and Advertising an AirBnB property - We establish correlation among variables



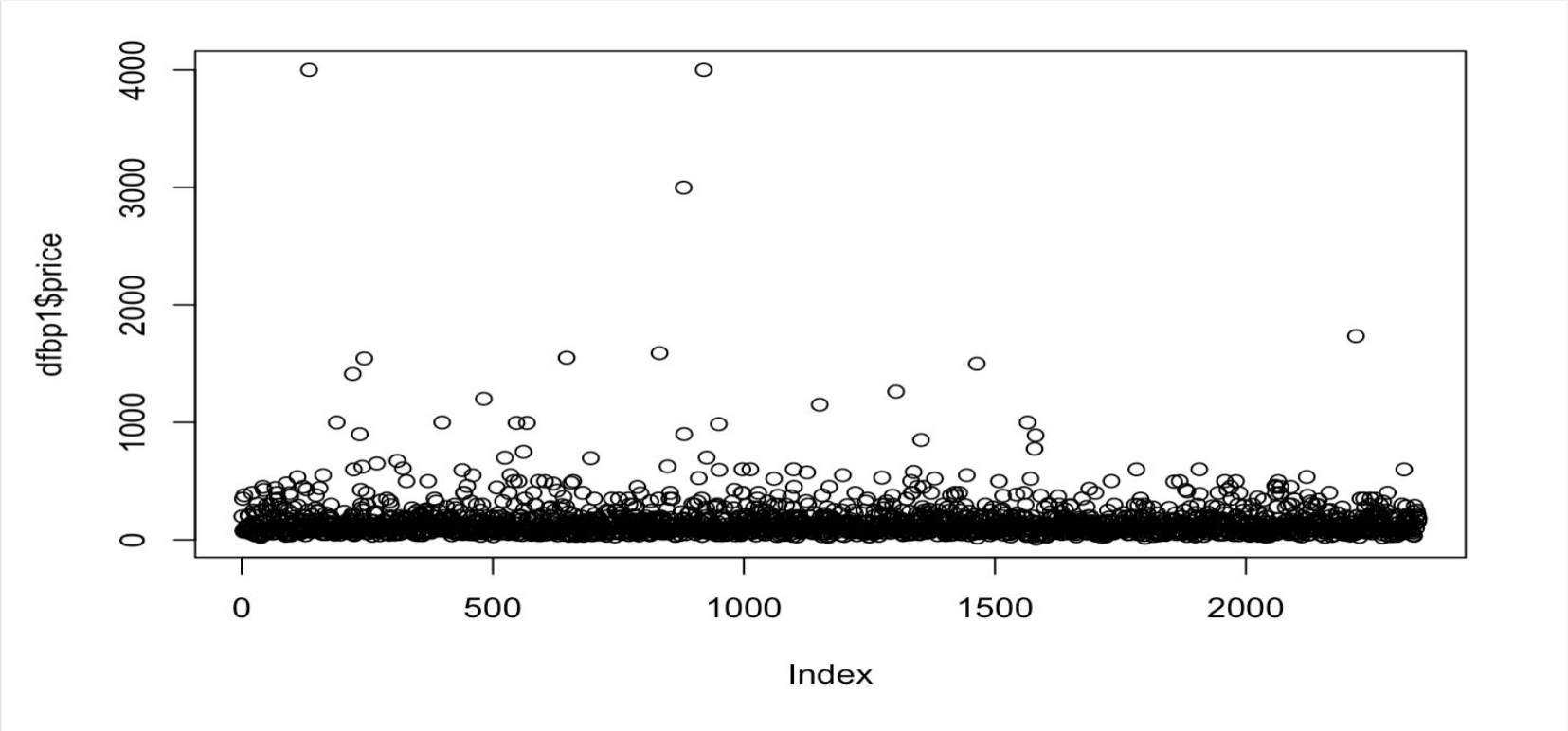
There does not exist positive correlation between Prices and High Booking Rate. So no direct inferences can be made

	high_booking_rate	price
high_booking_rate	1.0000000	-0.1011064
price	-0.1011064	1.0000000

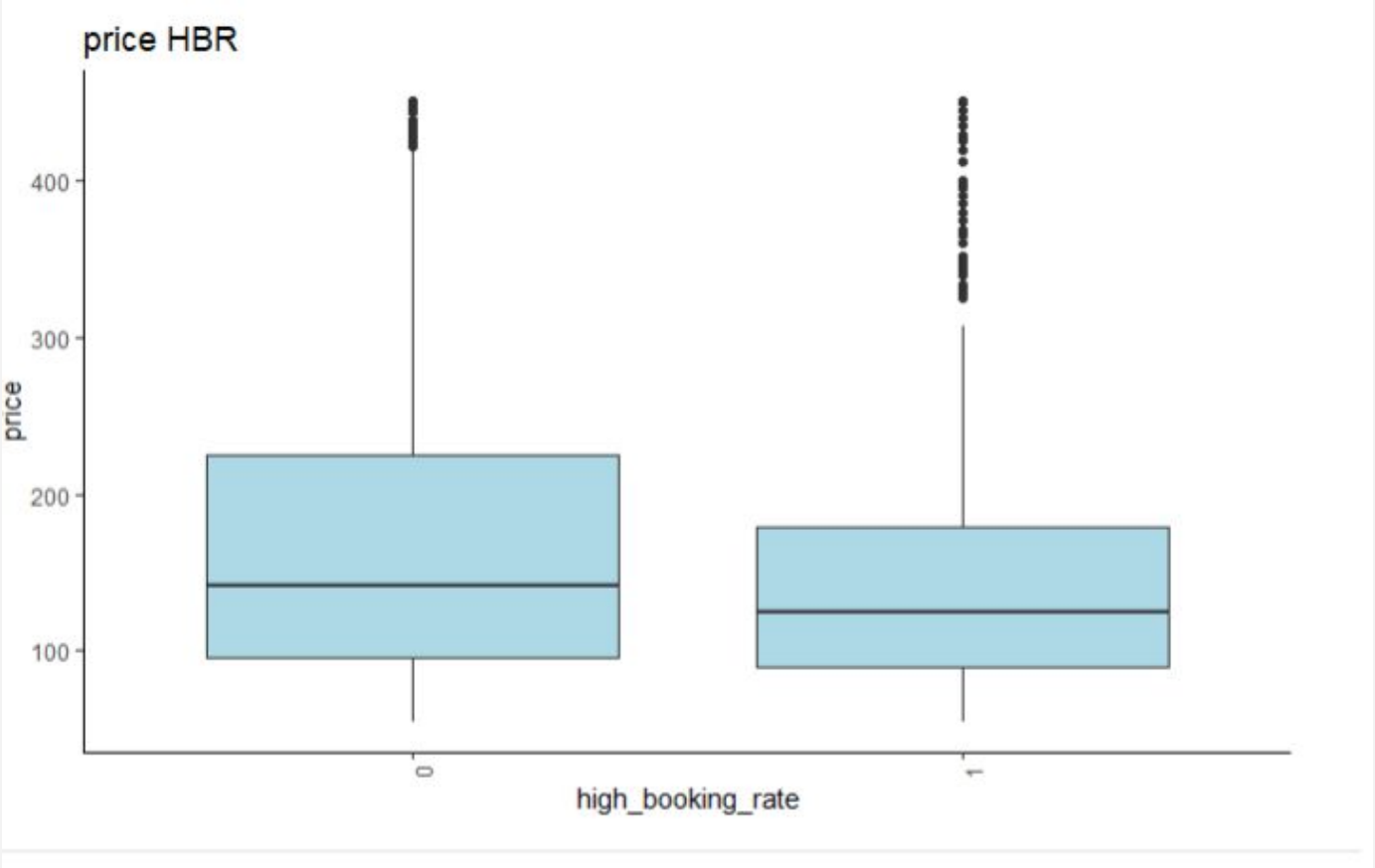
Prices of the property with low booking rate



Prices of the property with High booking rate



Boxplot of prices with High booking rate



Conclusion:

The best price range of the properties with higher booking rates is under $500.

Business Case 2

Is Booking Rate of a property dependent on how “accommodative” an Airbnb property is ?

Variables considered

High_booking_rate,accommodates,availability_30,
availability_365,availability_60,availability_90,bathr
ooms,bedrooms,maximum_nights,minimum_nights,
guests_included,beds

Model Applied

logistic Regression Model

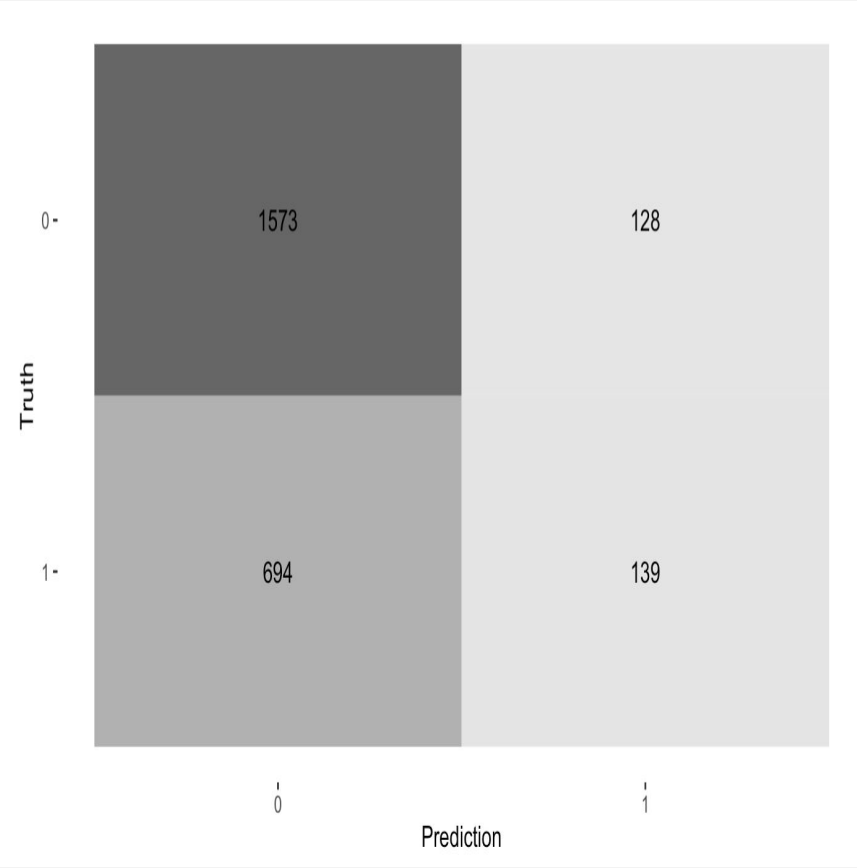
```
Call:
glm(formula = high_booking_rate ~ ., family = "binomial", data = dfcTrain)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.4886  -0.8532  -0.6254   1.1839   3.0063

Coefficients:
                  Estimate Std. Error z value Pr(>|z|)
(Intercept)     -4.521e-01  9.449e-02  -4.784 1.71e-06 ***
accommodates     7.379e-02  2.518e-02   2.931 0.003378 **
availability_30  3.212e-02  9.123e-03   3.521 0.000431 ***
availability_365 7.256e-04  3.320e-04   2.186 0.028830 *
availability_60 -6.723e-02  9.400e-03  -7.153 8.52e-13 ***
availability_90  4.182e-02  4.603e-03   9.085  < 2e-16 ***
bathrooms       -6.147e-01  7.434e-02  -8.268  < 2e-16 ***
bedrooms        -1.700e-01  5.764e-02  -2.949 0.003189 **
maximum_nights  -3.586e-04  6.202e-05  -5.781 7.40e-09 ***
minimum_nights  -7.546e-02  9.032e-03  -8.354  < 2e-16 ***
guests_included  5.316e-02  1.801e-02   2.951 0.003168 **
beds             3.632e-02  3.711e-02   0.979 0.327802
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6288.9  on 5293  degrees of freedom
Residual deviance: 5736.9  on 5282  degrees of freedom
AIC: 5760.9

Number of Fisher Scoring iterations: 6
```

p-values indicates that statistically important variables are

accommodates,availability_30, availability_365,availability_60, availability_90,bathrooms, bedrooms,maximum_nights, minimum_nights, guests_included

Accuracy of the model

```
Confusion Matrix and Statistics

                high_booking_rate
predictedClass    0    1
             0 1573  694
             1  128  139

               Accuracy : 0.6756
                 95% CI : (0.657, 0.6938)
    No Information Rate : 0.6713
    P-Value [Acc > NIR] : 0.3292
```



Confusion matrix is used to find the Accuracy as the dataset was highly skewed.

Conclusion: For an Airbnb property to have higher booking rates, it must be flexible with respect to its booking duration and be able to provide accommodation to the guests.

Business Case 3

Is the high booking rate affected by various charges included with price?

Variables considered

- Cleaning_fee
- Extra_people
- Price
- Security_deposit

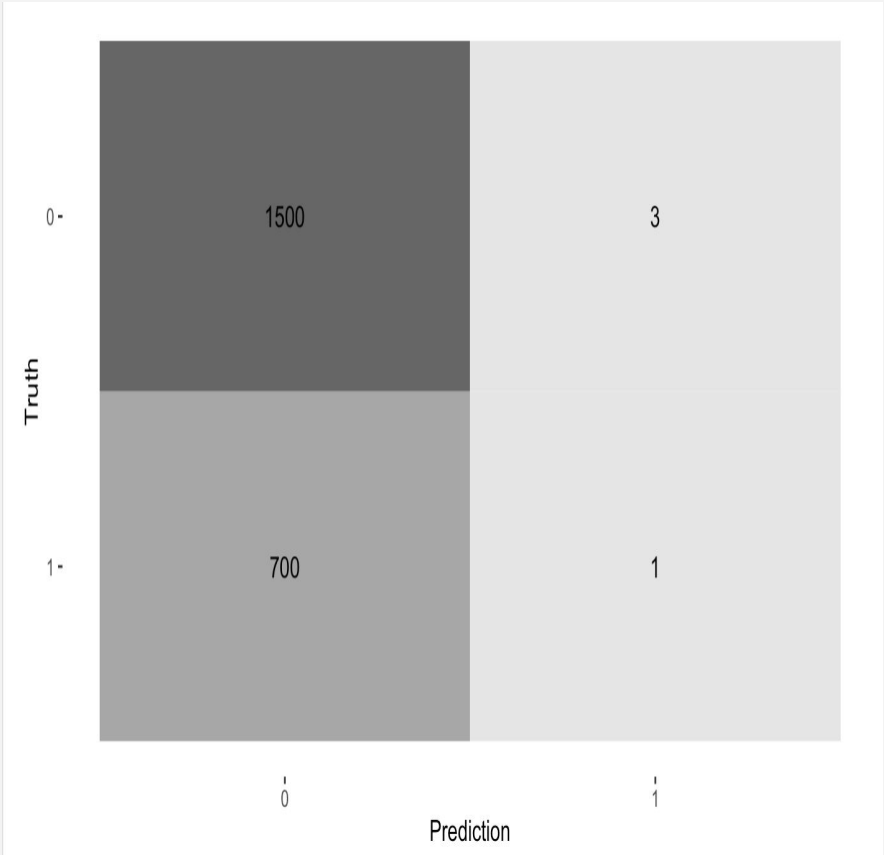
Model Applied

Logistic Regression Model

```
Call:
glm(formula = high_booking_rate ~ ., family = "binomial", data = dfcTrain)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.4240  -0.8881  -0.7884   1.4429   3.7715

Coefficients:
                   Estimate Std. Error z value Pr(>|z|)
(Intercept)      -5.492e-01  4.877e-02 -11.261  < 2e-16 ***
cleaning_fee     -8.307e-04  4.865e-04  -1.707 0.087733 .
extra_people      4.464e-03  1.190e-03   3.752 0.000176 ***
price            -1.630e-03  2.554e-04  -6.384 1.72e-10 ***
security_deposit -5.069e-05  8.361e-05  -0.606 0.544305
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6398.2  on 5293  degrees of freedom
Residual deviance: 6240.1  on 5289  degrees of freedom
AIC: 6250.1

Number of Fisher Scoring iterations: 6
```

Only extra-people and price are statistically important variables

```
Confusion Matrix and Statistics

                high_booking_rate
predictedClass    0    1
             0 1500  700
             1    3    1

               Accuracy : 0.681
                 95% CI : (0.6611, 0.7005)
    No Information Rate : 0.6819
    P-Value [Acc > NIR] : 0.5466
```



Conclusion

- If a property provides for extra_people despite charging for the same - its booking rate improves.
- Cleaning fee and security deposits do not have any impact on the higher booking rates.
- If the price of a property is high, its booking rate decreases.

Business Case 4

Does being a superhost affect booking rate?

Variable Selection

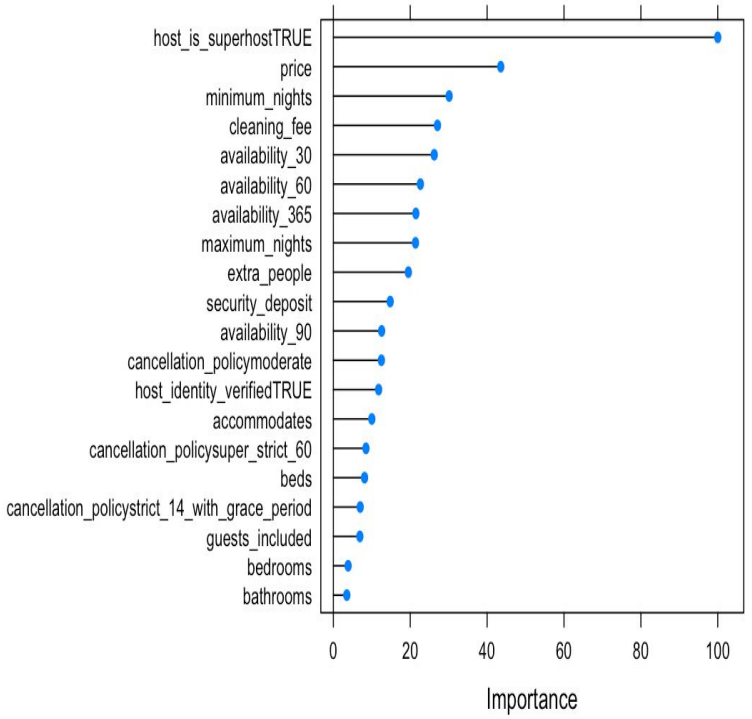
- Factors that contribute towards the location setting, generalized pricing strategy and in house services provided, were considered while structuring this business case
- Initially, a logistic model was run to understand the importance and significance of each variable
- Accuracy achieved for this model was 77.49%

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.2849  -0.7233  -0.4239   0.7975   4.2468

Coefficients:
                                              Estimate Std. Error z value Pr(>|z|)
(Intercept)                                -2.334e+00  1.328e-01 -17.581  < 2e-16 ***
host_is_superhostTRUE                       1.438e+00  6.872e-02  20.926  < 2e-16 ***
price                                      -1.774e-03  3.194e-04  -5.555 2.77e-08 ***
minimum_nights                             -5.928e-02  7.562e-03  -7.839 4.54e-15 ***
cleaning_fee                               -3.518e-03  7.180e-04  -4.900 9.57e-07 ***
availability_365                            1.786e-03  3.567e-04   5.006 5.55e-07 ***
availability_60                            -4.997e-02  9.835e-03  -5.081 3.76e-07 ***
availability_30                             3.538e-02  9.378e-03   3.773 0.000162 ***
maximum_nights                             -2.563e-04  6.321e-05  -4.055 5.02e-05 ***
extra_people                               -3.194e-03  1.514e-03  -2.110 0.034901 *
security_deposit                            8.439e-05  9.221e-05   0.915 0.360116
availability_90                             2.800e-02  4.778e-03   5.860 4.62e-09 ***
cancellation_policymoderate                 1.114e+00  1.016e-01  10.970  < 2e-16 ***
host_identity_verifiedTRUE                  5.520e-01  6.833e-02   8.078 6.56e-16 ***
accommodates                                1.299e-01  2.666e-02   4.873 1.10e-06 ***
cancellation_policysuper_strict_60         -1.051e+00  3.066e-01  -3.429 0.000607 ***
beds                                        6.893e-05  3.709e-02   0.002 0.998517
cancellation_policystrict_14_with_grace_period 8.345e-01  9.989e-02   8.354  < 2e-16 ***
guests_included                             9.308e-02  2.111e-02   4.409 1.04e-05 ***
bedrooms                                   -7.141e-02  6.063e-02  -1.178 0.238868
bathrooms                                  -3.396e-01  7.541e-02  -4.504 6.68e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6870.6  on 5700  degrees of freedom
Residual deviance: 5340.6  on 5680  degrees of freedom
AIC: 5382.6

Number of Fisher Scoring iterations: 6
```

XG Boost as a reference model for variable selection

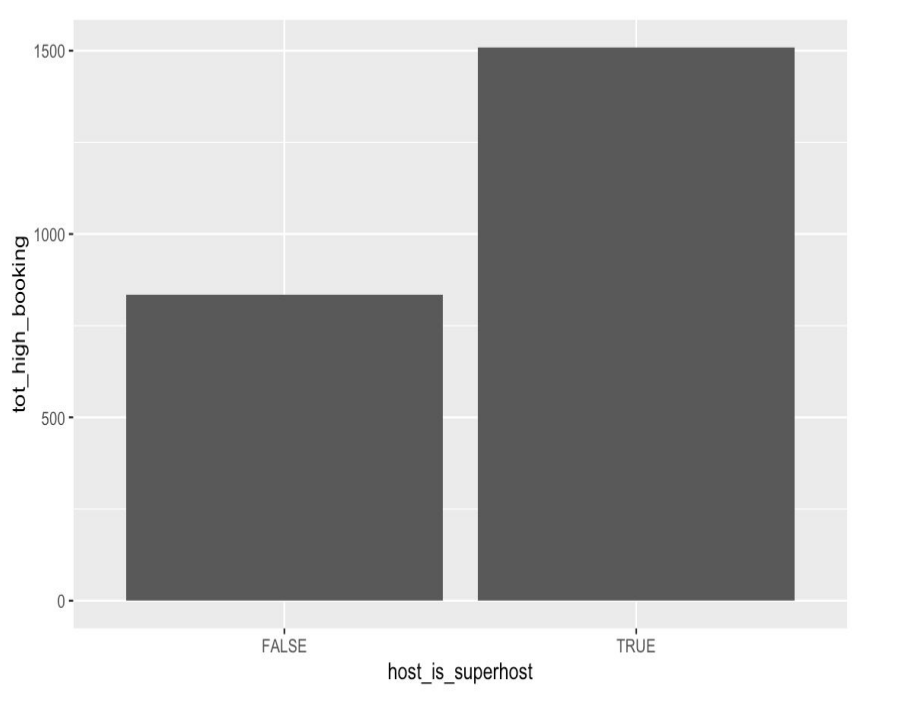
The Xgboost model showed an accuracy of 79.38% and Sensitivity of 52.32%. The sensitivity is more important in this particular case as we don't want to overestimate the High_booking_rate factor.

```
Confusion Matrix and Statistics

                 high_booking_rate
predictedClass     0    1
             0  1811  391
             1   191  429

               Accuracy : 0.7938
                 95% CI : (0.7784, 0.8086)
    No Information Rate : 0.7094
    P-Value [Acc > NIR] : < 2.2e-16

                  Kappa : 0.461

 Mcnemar's Test P-Value : < 2.2e-16

            Sensitivity : 0.5232
            Specificity : 0.9046
         Pos Pred Value : 0.6919
         Neg Pred Value : 0.8224
             Prevalence : 0.2906
         Detection Rate : 0.1520
   Detection Prevalence : 0.2197
      Balanced Accuracy : 0.7139

       'Positive' Class : 1
```



How does a host being a superhost affect booking rate?

The most important variable from the XGBoost model is the host_is_superhost = True. From the bar graph, we can see that the booking rate for host_is_superhost = True is about 55% more than where host is not a superhost



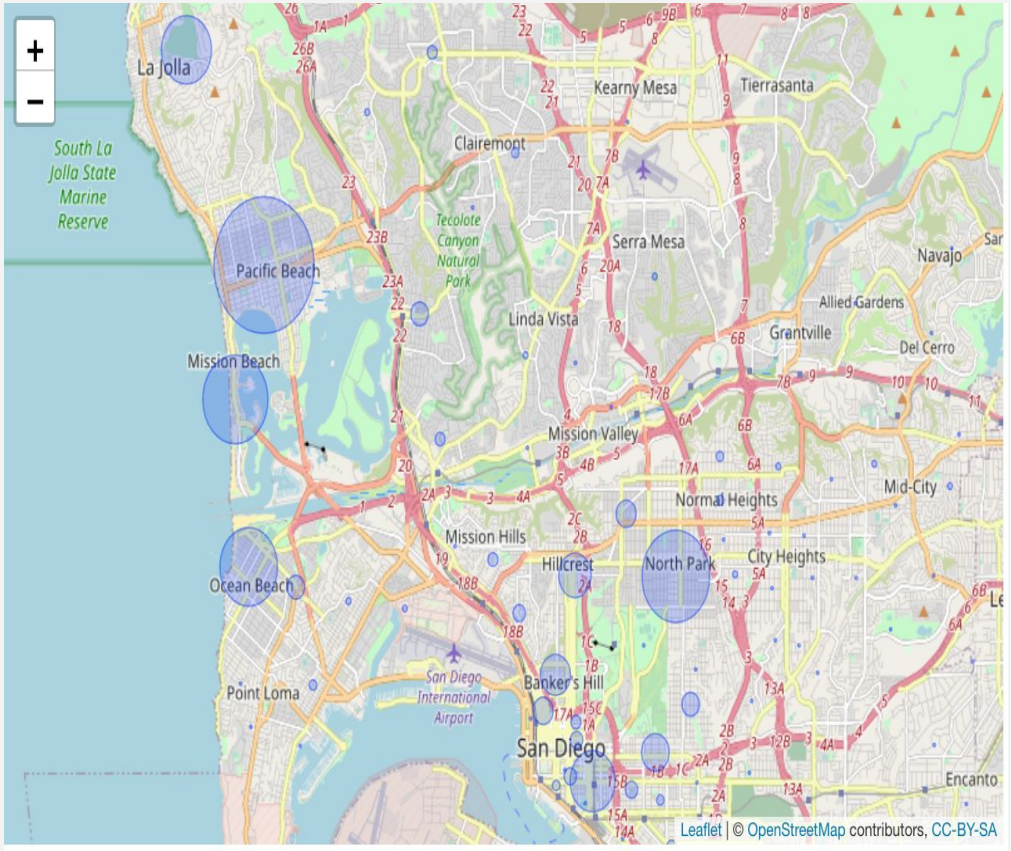
Conclusion

- Variables, excluding security deposits, beds and bedrooms are statistically important
- While the host holding a superhost status improves the booking rate the most

Business Case 5

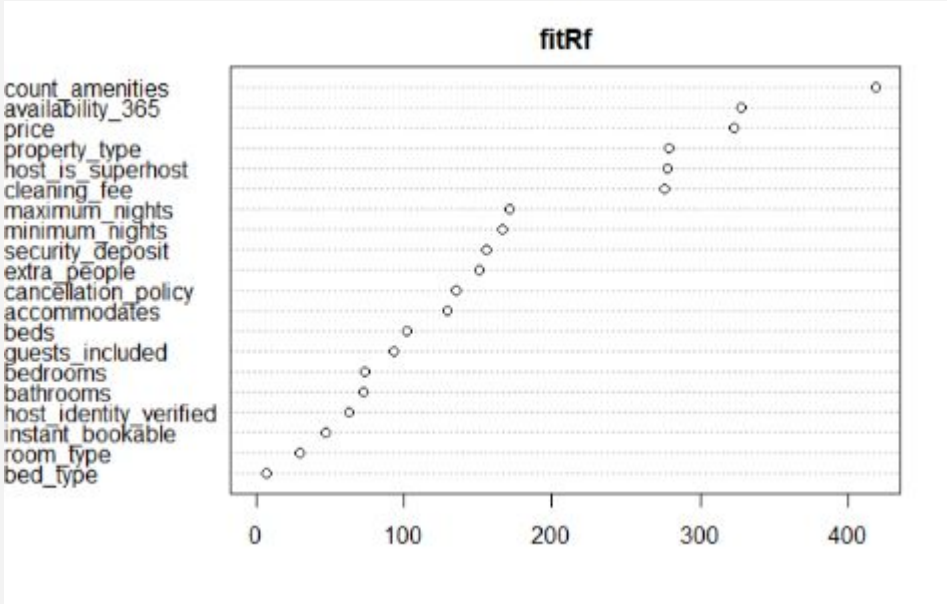
Which neighbourhoods result in a higher booking rate?

- The regions and the number of high booking rates are displayed on the map. The size of the circle also correlates with the number of high booking rates. These regions can be used as a factor to decide on initial acquisition as well as pricing.
- Due to various events like the Comic Con, Surfing tournaments, and La Jolla festival at La Jolla and general attraction for beaches, we assume that these regions have a higher booking rate.



Business Case 6

How do the provided amenities affect the booking rate of an AirBnB Property?


fitRf
count_amenities
availability_365
price
property_type
host_is_superhost
cleaning_fee
maximum_nights
minimum_nights
security_deposit
extra_people
cancellation_policy
accommodates
beds
guests_included
bedrooms
bathrooms
host_identity_verified
instant_bookable
room_type
bed_type
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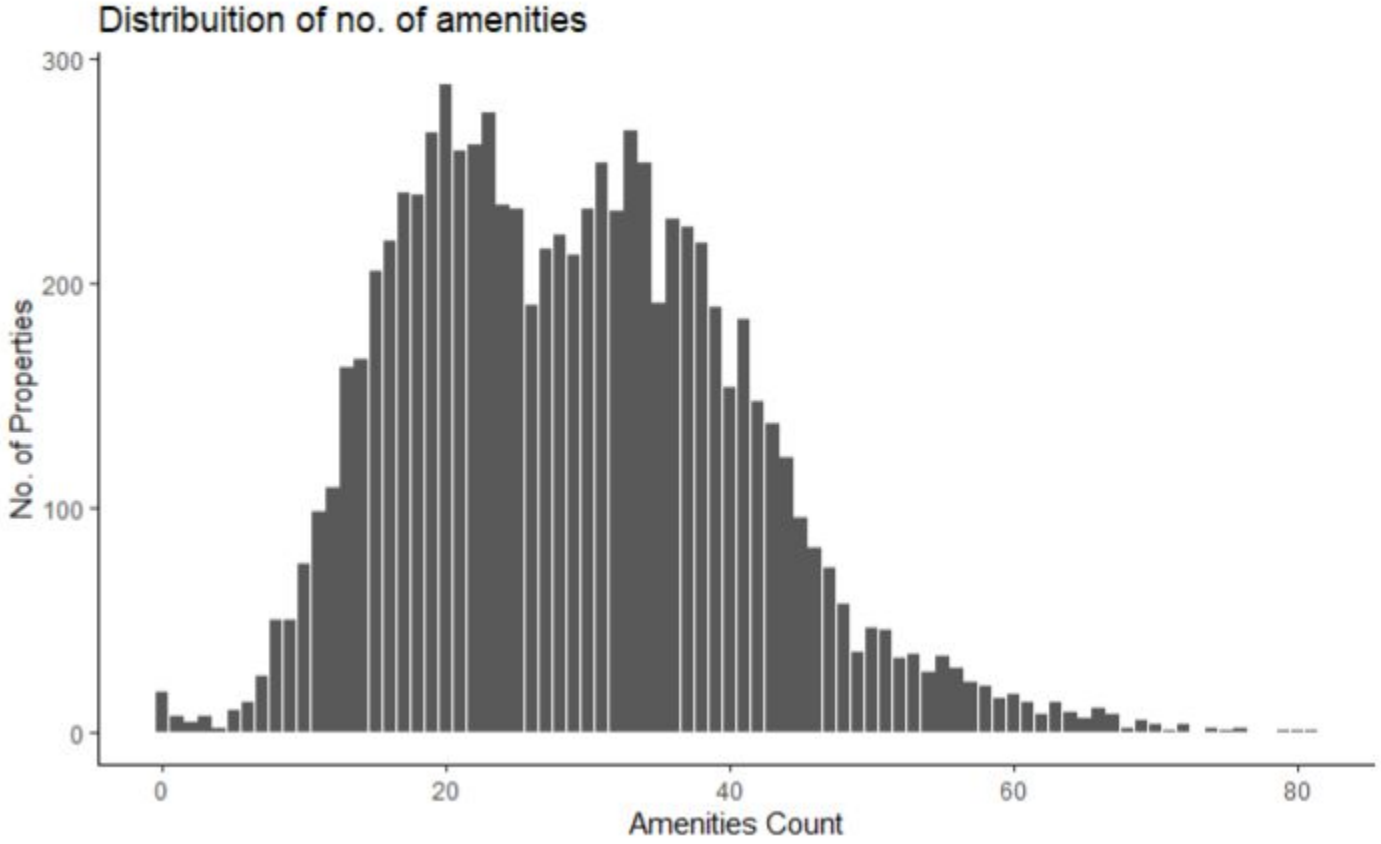
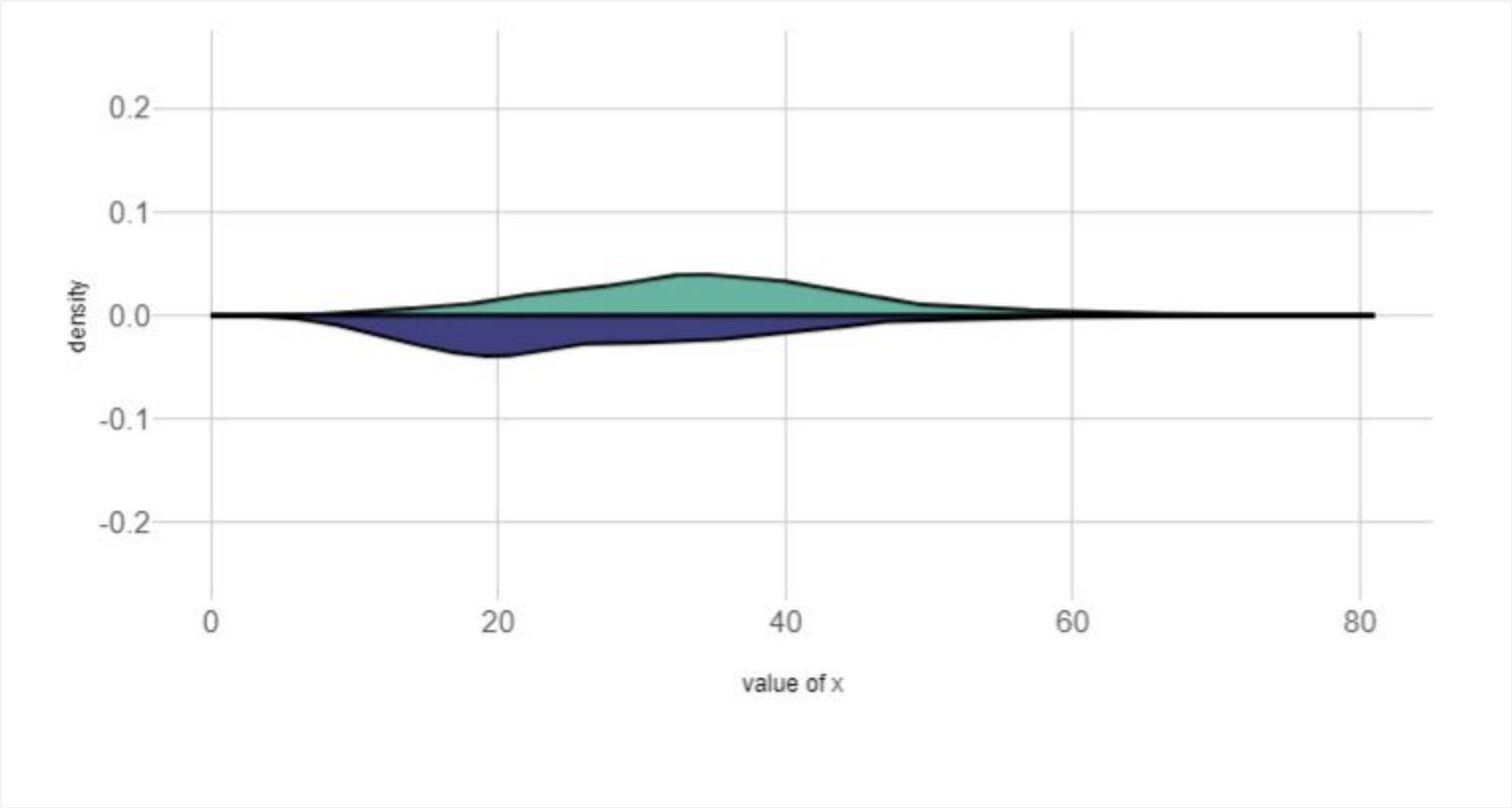
100
200
300
400


Distribuition of no. of amenities
No. of Properties
300
200
100
0
0
20
40
60
80
Amenities Count


0.2
0.1
0.0
-0.1
-0.2
density
0
20
40
60
80
value of x

extinguisher
microwave
linens
heating
stove
term
washer
stairs
stays
patio
kitchen
entrance
allowed
fire
kid
first
iron
check
silverware
water
hot
dryer
hair
air
basics
cable
detector
private
self
kit
maker
laptop
parking
enter
wifi
coffee
oven
friendly
shampoo
lock
balcony
dishes
bed
aid
steps
pillows
hangers
refrigerator
long
workspace
extra
family
cooking
blankets

blankets
term
extinguisher
bbq
basics
washer
kitchen
kit
workspace
stays
hangers
private
fireplace
fire
patio
pillows
steps
linens
door
wifi
hair
water
long
aid
cable
parking
entrance
coffee
air
kid
self
dishes
maker
detector
silverware
oven
pets
first
bed
lock
check
tub
internet
indoor
laptop
dryer
iron
enter
friendly
microwave
allowed
cooking
bedroom
stove
heating
refrigerator
balcony
hot
wide
family
dishwasher
shampoo
pool
conditioning
extra
room
stairs
grill

Thank You