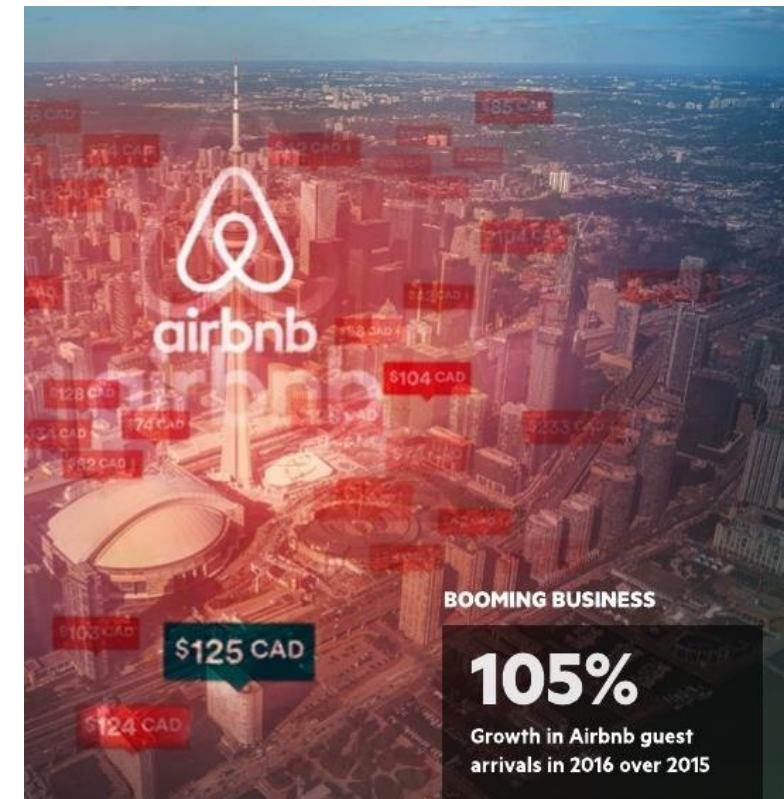# INVESTIGATING THE FACTORS THAT AFFECT THE NIGHTLY PRICE OF TORONTO AIRBNB LISTINGS

Nicholas Jalen Cheng
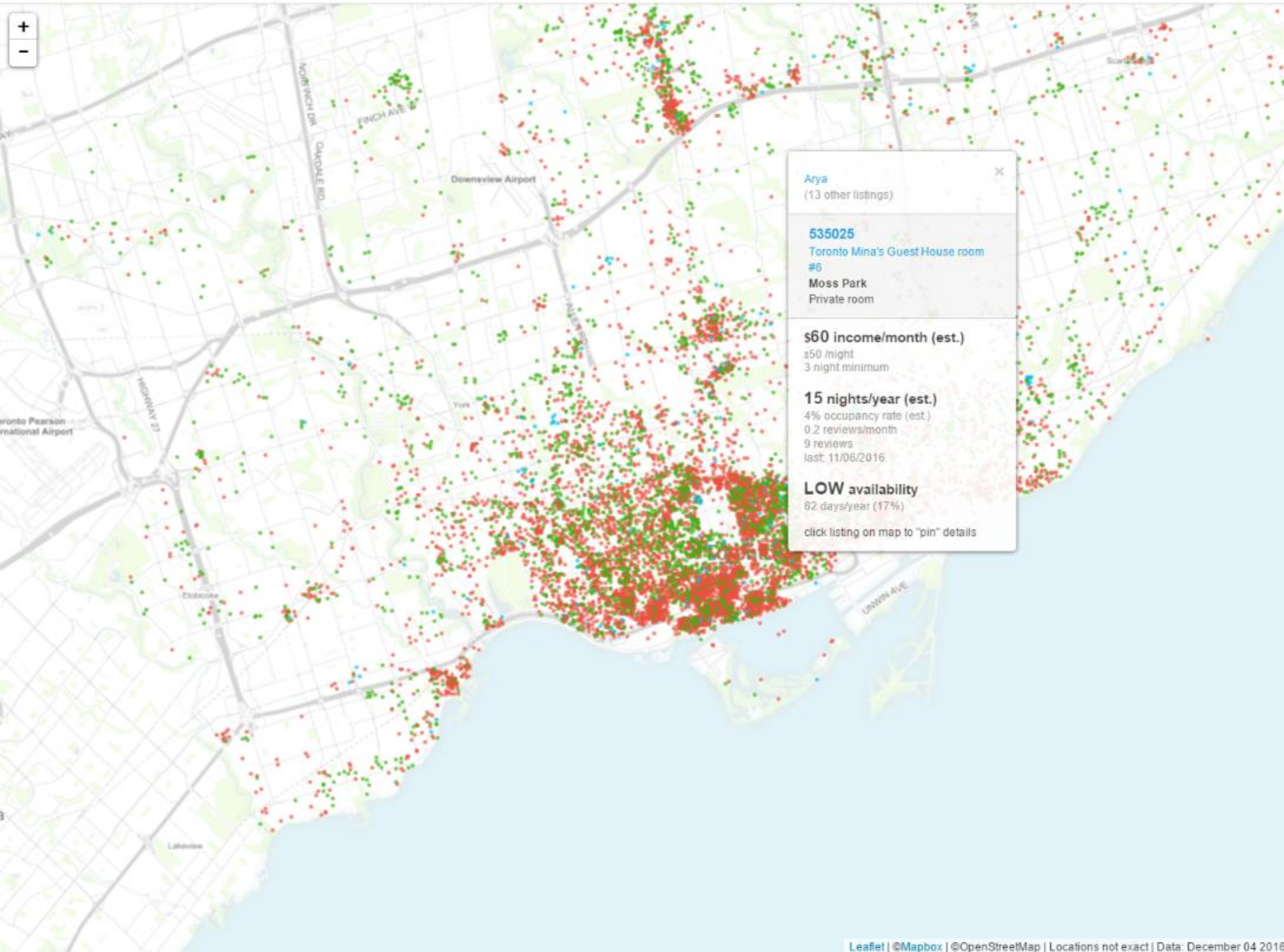
Alex Kwan

Ron Suprun

Jiming Zhou

Toronto

Filter by:

Toronto ▼

**12,029**
out of 12,029 listings (100%)

About Airbnb in Toronto

How is Airbnb really being used in and affecting your neighborhoods?

Arya
(13 other listings)   ✕

535025
Toronto Mina's Guest House room
#6
Moss Park
Private room

$60 income/month (est.)
$50 /night
3 night minimum

15 nights/year (est.)
4% occupancy rate (est.)
0.2 reviews/month
9 reviews
last: 11/06/2016

LOW availability
62 days/year (17%)

click listing on map to "pin" details

Room Type

☐ Only entire homes/apartments

Airbnb hosts can list entire homes/apartments, private or shared rooms.

Depending on the room type, availability, and activity, an airbnb listing could be more like a hotel, disruptive for neighbors, taking away housing, and illegal.

Entire home/apt ▬▬▬▬

Private room ▬▬

Shared room ▮

0   5,000
listings
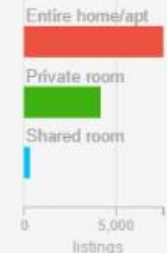
62.7%
entire homes/apartments

$123
price/night

7,544 (62.7%)
entire home/apartments

4,155 (34.5%)
private rooms

330 (2.7%)
shared rooms

Activity

☐ Only recent and frequently booked

Airbnb guests may leave a review after their stay, and these can be used as an indicator of airbnb activity.

The minimum stay, price and number of reviews have been used to estimate the **occupancy rate**, the number of **nights per year** and the **income per month** for each listing.

How does the income from Airbnb compare to a long-term lease?

Do the number of nights booked per year make it impossible for a listing to be used for residential housing?

And what is renting to a tourist full-time rather than a resident doing to our neighborhoods and cities?

90
estimated nights/year

1.4
reviews/listing/month

166,437
reviews

$123
price/night

24.7%
estimated occupancy

$844
estimated income/month

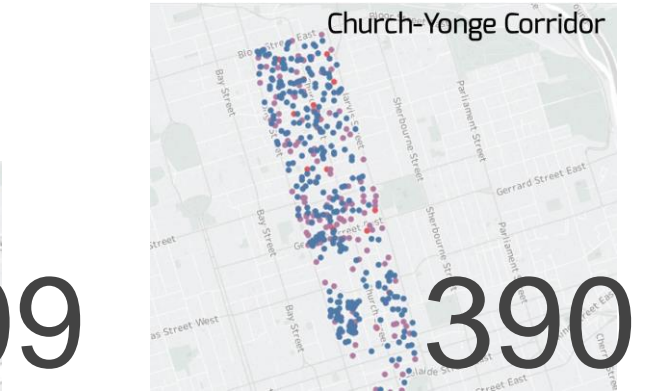|	2011	%
Total	29,155	100%
Children 0-14	2,195	7.5%
Youth 15-24	3,895	13.4%
Working Age 25-64	18,260	62.6%
Seniors 65+	4,805	16.5%

Income Distribution by Groups 2005

Category	Census Family	Private Household	1-person Private Household
Average income - $	181,587	112,510	65,735

Toronto Real Estate Board

SUMMARY OF RENTAL TRANSACTIONS

APARTMENTS, FOURTH QUARTER 2016
CITY OF TORONTO MUNICIPAL BREAKDOWN

	All Apartments		Bachelor		One-Bedroom		Two-Bedroom		Three-Bedroom	
	Total Listed [1]	Total Leased [2]	Leased [2]	Avg. Lease Rate [3]	Leased [2]	Avg. Lease Rate [3]	Leased [2]	Avg. Lease Rate [3]	Leased [2]	Avg. Lease Rate [3]
TREB Total	9,545	5,717	227	$1,512	3,379	$1,776	1,988	$2,415	123	$3,283
City of Toronto Total	7,769	4,606	223	$1,517	2,776	$1,819	1,505	$2,567	102	$3,493
Toronto West	992	666	5	$1,305	392	$1,628	252	$2,203	17	$2,629
Toronto W01	94	60	0	-	40	$1,837	20	$2,657	0	-
Toronto W02	43	23	1	$1,500	14	$1,698	7	$3,200	1	$2,550
Toronto W03	6	4	0	-	2	$1,275	1	$1,900	1	$2,250
Toronto W04	209	147	0	-	84	$1,499	60	$1,829	3	$2,483
Toronto W05	44	21	2	$1,038	13	$1,650	5	$2,010	1	$2,375
Toronto W06	305	203	2	$1,475	106	$1,682	91	$2,461	4	$3,788
Toronto W07	13	6	0	-	3	$1,667	3	$2,333	0	-
Toronto W08	234	175	0	-	118	$1,611	51	$2,013	6	$2,154
Toronto W09	8	2	0	-	0	-	1	$1,950	1	$2,000
Toronto W10	36	25	0	-	12	$1,462	13	$1,712	0	-

29.2%
Houses

63.2%
Condos

3 Most Popular Listing Neighbourhoods

Liberty Village

497

Waterfront Community

1609

Church-Yonge Corridor

390
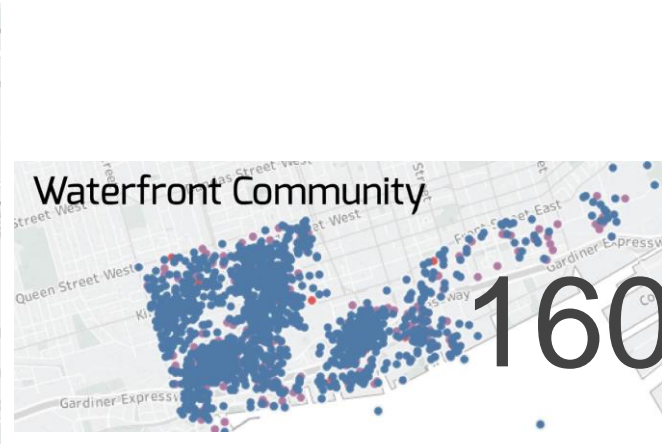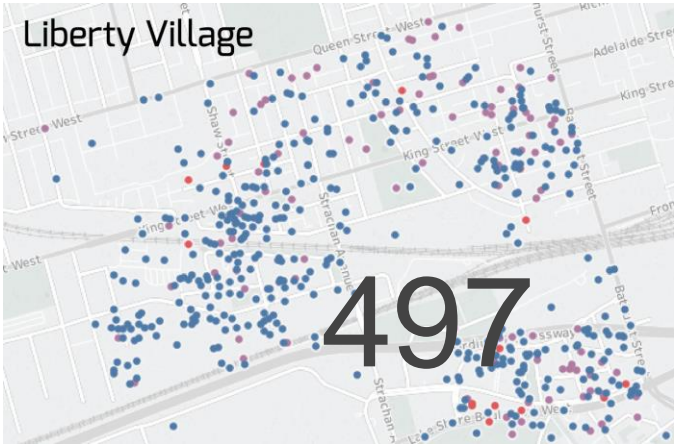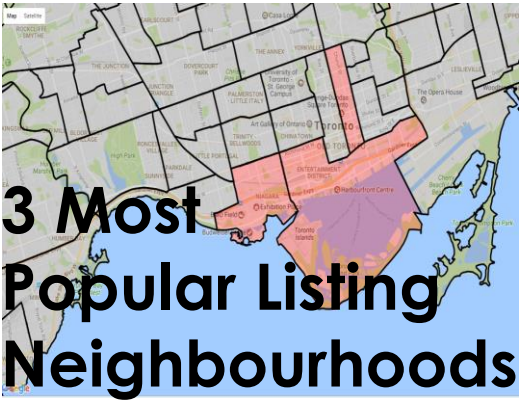
▶ EASY TO INTERPRET

▶ FLEXIBLE

▶ GOOD STARTING POINT FOR ANALYSIS

Why Multivariable Linear Regression?

	Regular Regression	Add Lasso
MSE	17424	17728
R²	0.264	0.2434

G	H	I	J
Property Type	isHou	isTownHou	isApt
2	1	0	0
3	0	0	1
1	0	1	0

$$\min_{\beta_0,\beta_1,...,\beta_K} \quad \frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)^2 + \lambda\sum_{k=1}^{K}|\beta_k|$$

$$\text{s.t.} \quad \hat{y}_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_K x_{iK}, \quad i = 1,...,n$$

	Regular Regression	Add Lasso	Remove Lasso & Add Neighbourhood Data	Remove Insignificant Variables	Remove Outliers
MSE	17424	17728	17161	17689	4395.69
R^2	0.264	0.2434	0.285	0.258	0.504

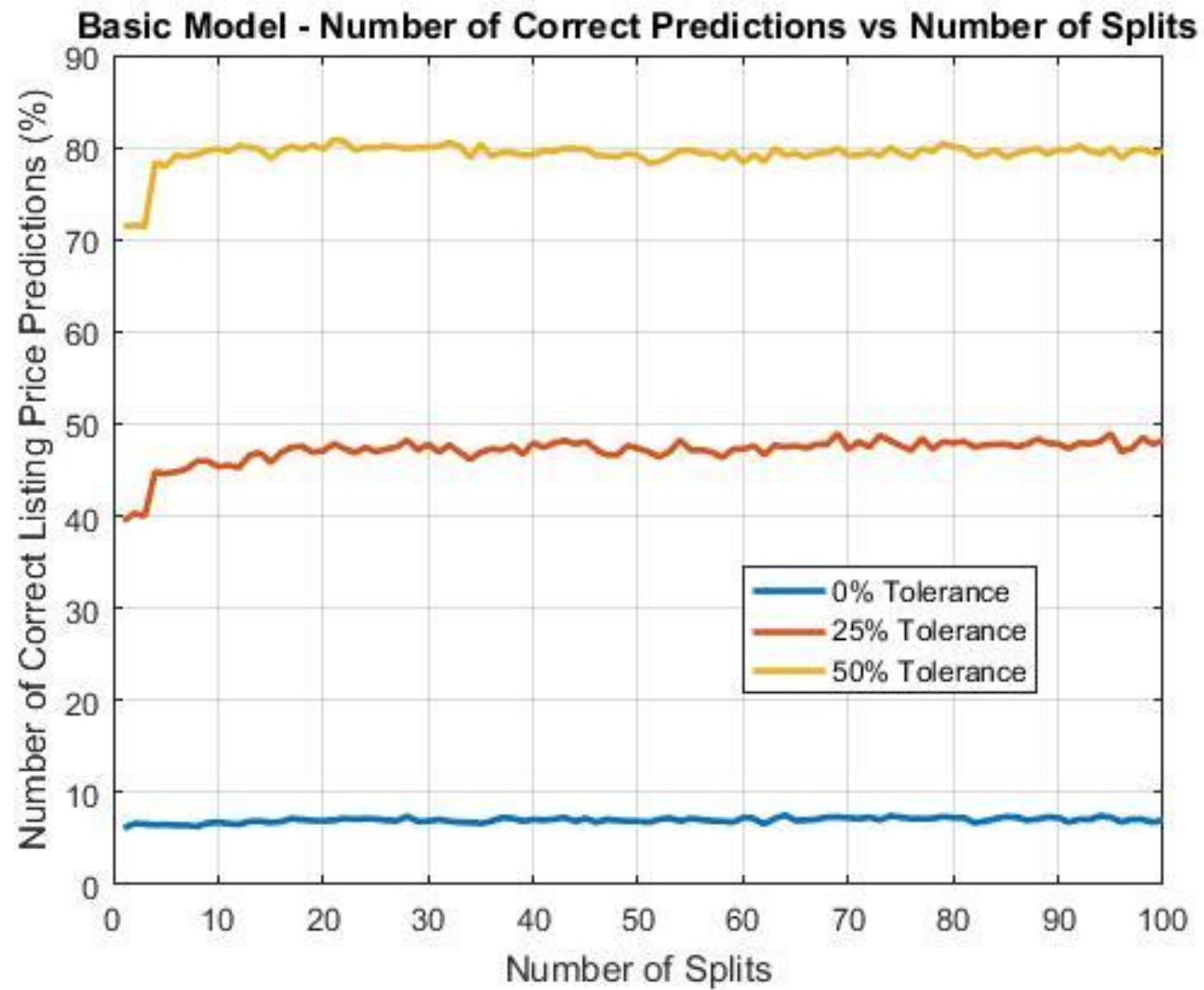|	2001	%	2006
Total	28,835	100%	30,175
Children 0-14	4,800	16.6%	4,740
Youth 15-24	4,445	15.4%	4,325
Working Age 25-64	16,470	57.1%	16,815
Seniors 65+	3,120	10.8%	4,295

CHECKING LINEAR MODEL ASSUMPTIONS
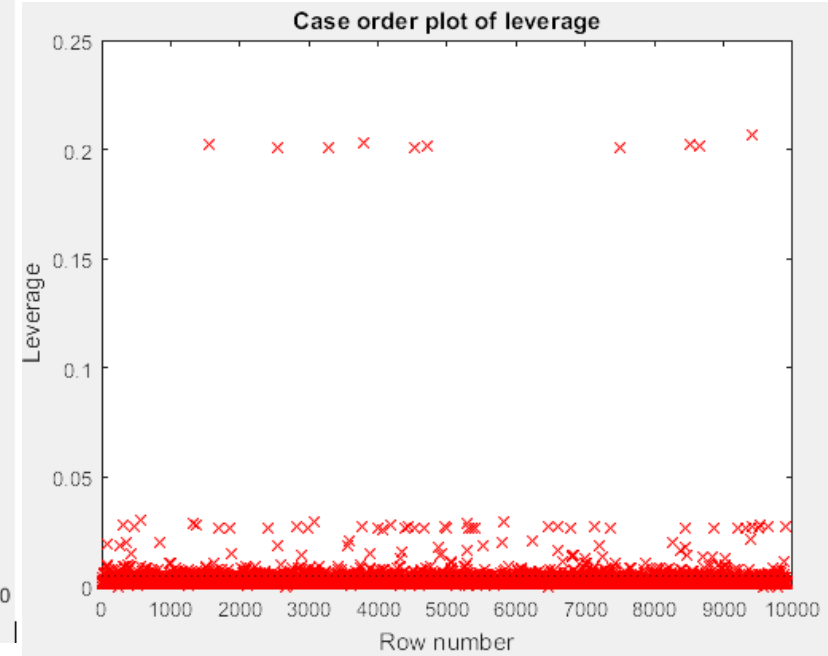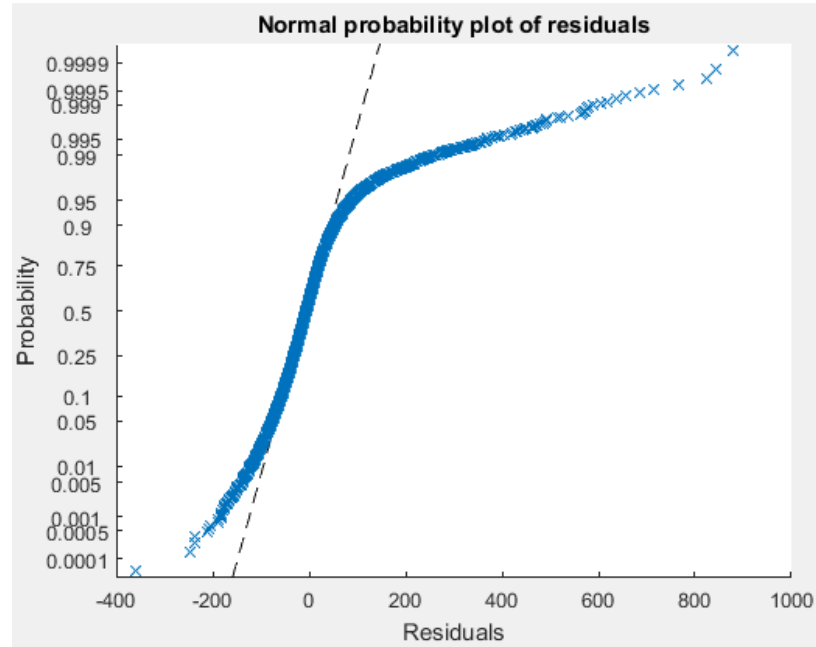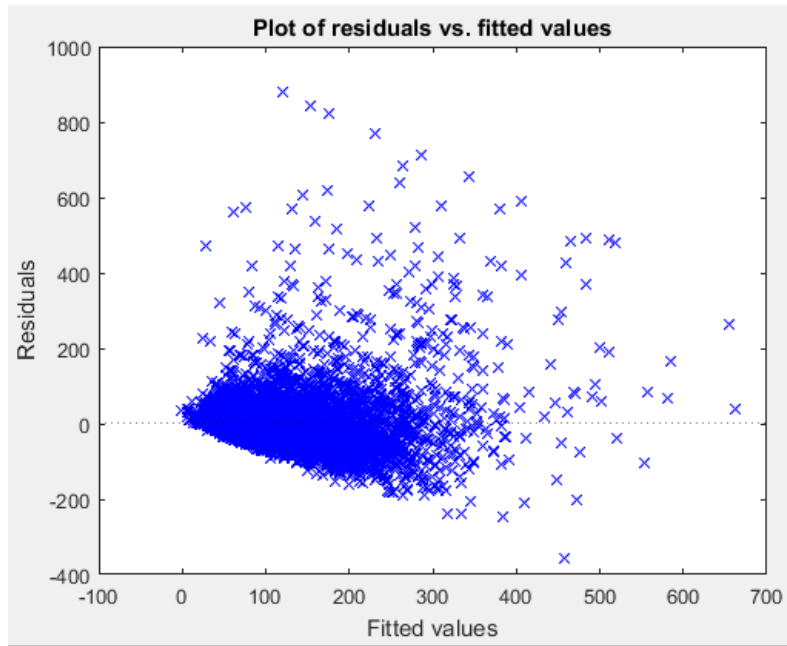
NORMALITY ASSUMPTION NOT MET - LET'S TRY NON-LINEAR MULTIPLE REGRESSION

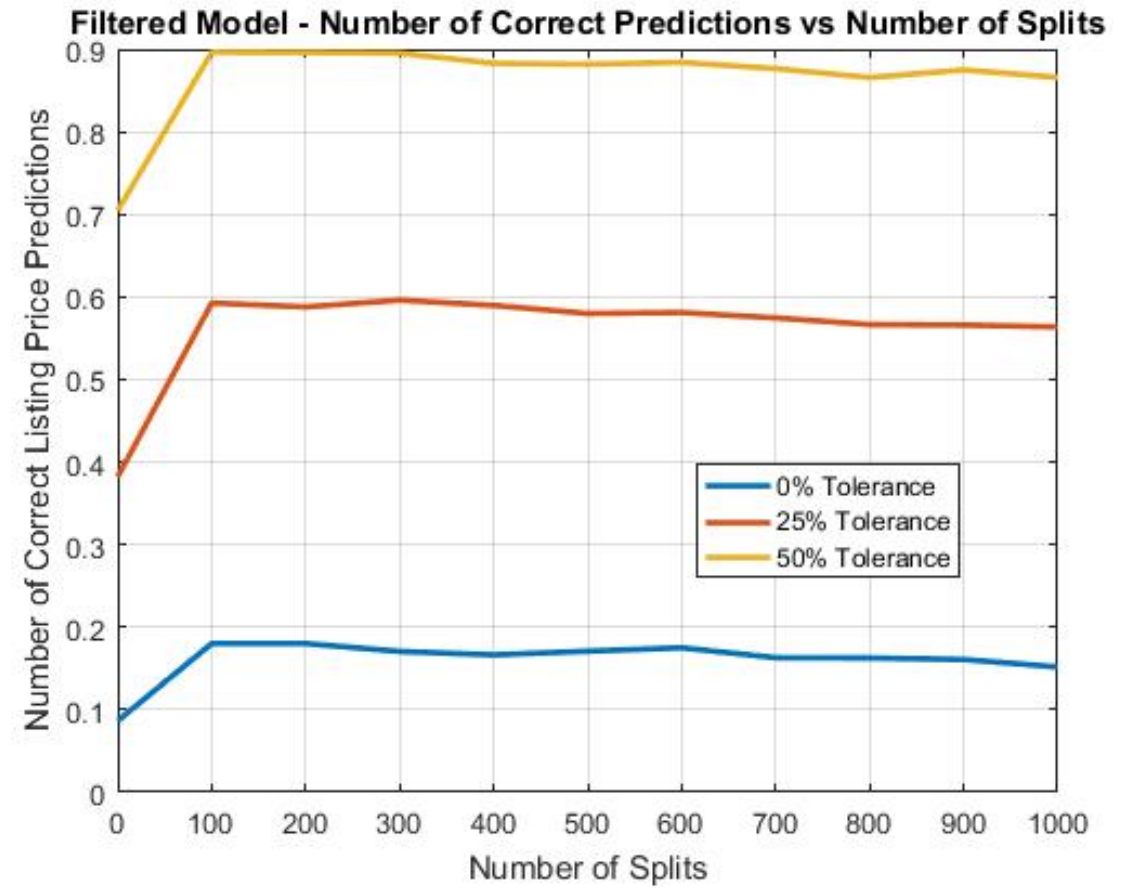Warning: Regression design matrix is rank deficient to within machine precision.
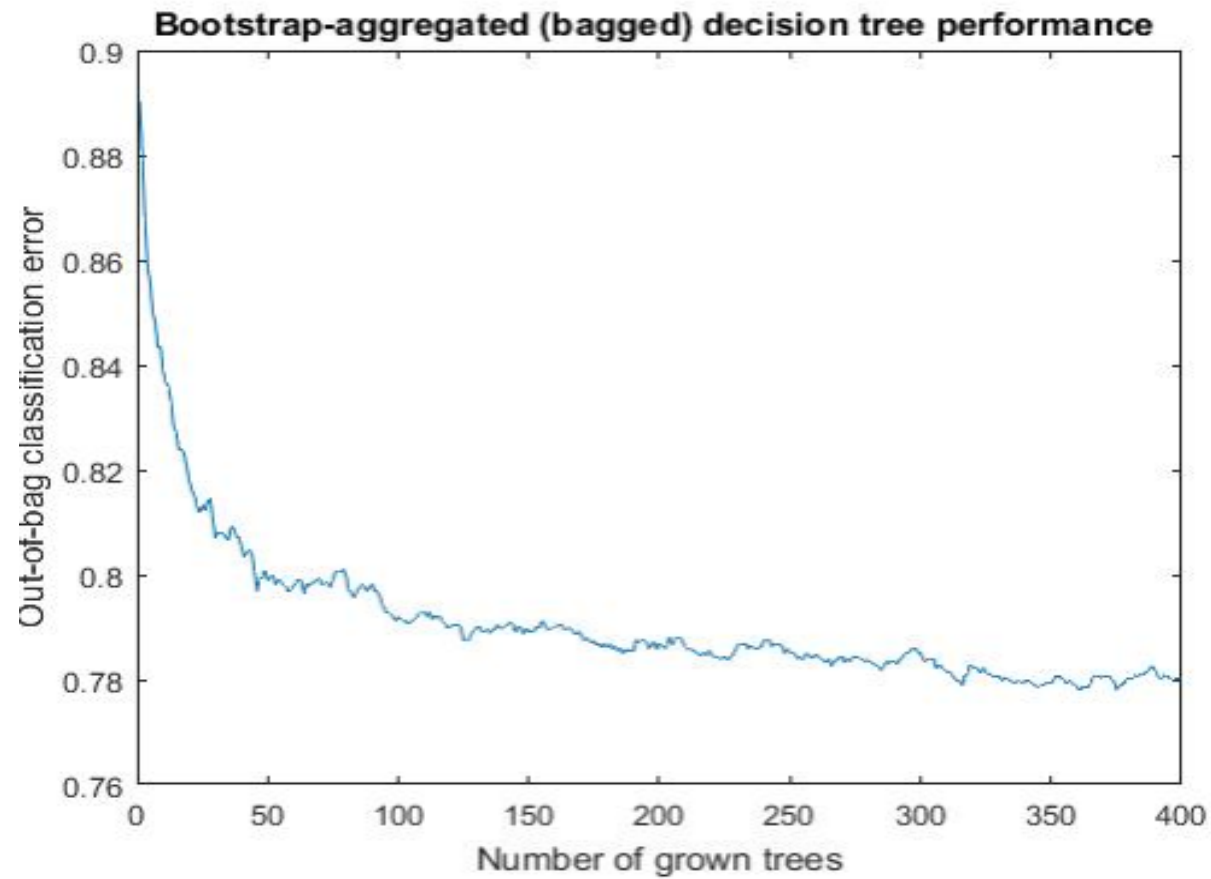
▶ Relatively Fast

▶ All Types of Variables (Numeric, Binary, Categorical)

▶ Resistant to irrelevant variables
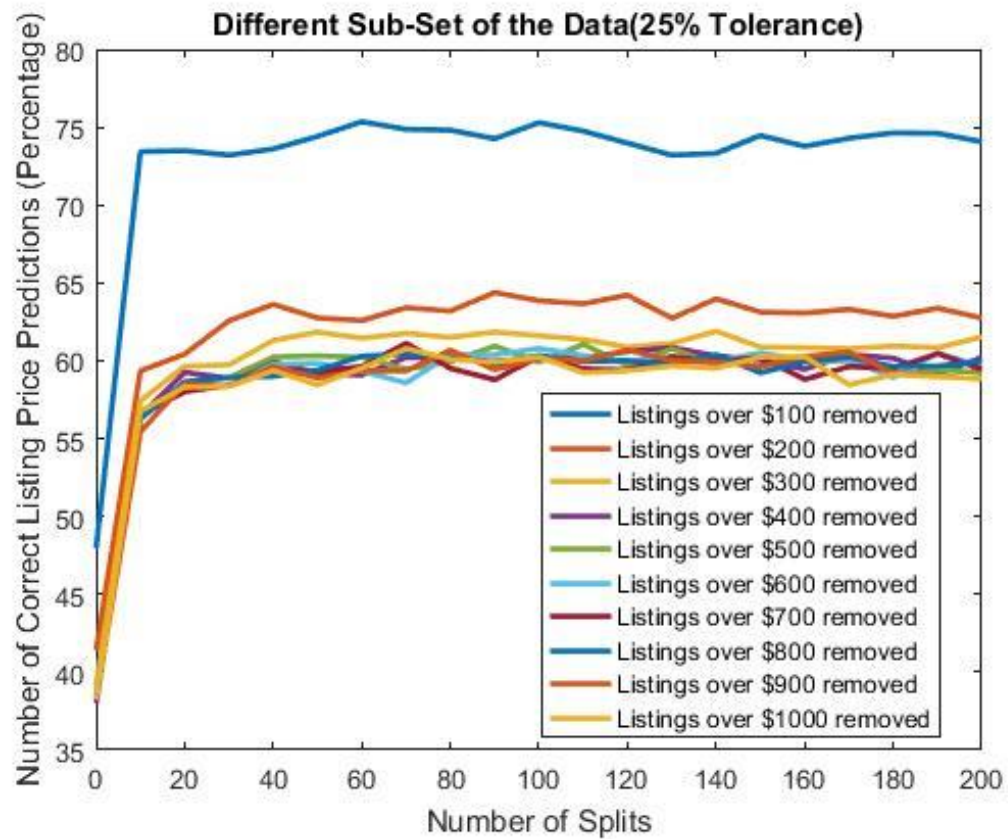
▶ Easily interpretable model representation

Why CART?

Basic Model that includes everything

Bootstrap-aggregated (bagged) decision tree performance

Filtered Model - Number of Correct Predictions vs Number of Splits

Filtered Model that predicts with a $10 interval, and only with listings above 40% occupancy rate

Different Sub-Set of the Data(25% Tolerance)

Legend:
- Listings over $100 removed
- Listings over $200 removed
- Listings over $300 removed
- Listings over $400 removed
- Listings over $500 removed
- Listings over $600 removed
- Listings over $700 removed
- Listings over $800 removed
- Listings over $900 removed
- Listings over $1000 removed

X-axis: Number of Splits
Y-axis: Number of Correct Listing Price Predictions (Percentage)

room_type<1.5   room_type>=1.5

x_Children0_14<0.104   x_Children0_14>=0.104   bedrooms<1.5   bedrooms>=1.5

The listing traits that contribute to the price distinction beyond $100 aren't captured within this data set.
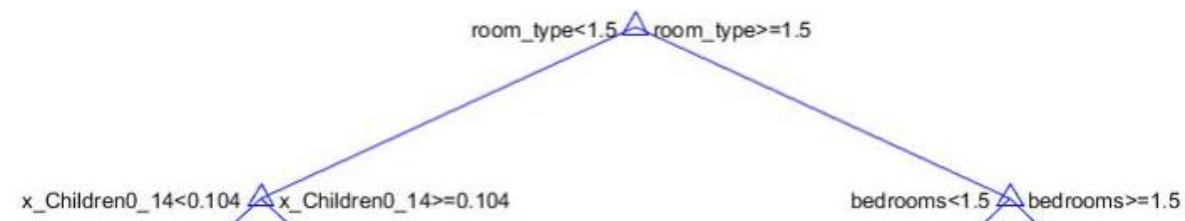
Most Significant Variables:

Room Type

Number of Bedrooms

Rental Price

Number of Bathrooms

Percentage of Children Between the age 0 to 14

May 2013

S	M	T	W	T	F	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

2 nights