Beijing City Feature-Based Airbnb Price Prediction

Team GeekHub

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Outline

Motivation

Problem Definition

State-of-the-Art

Methodology

Evaluation

Motivation

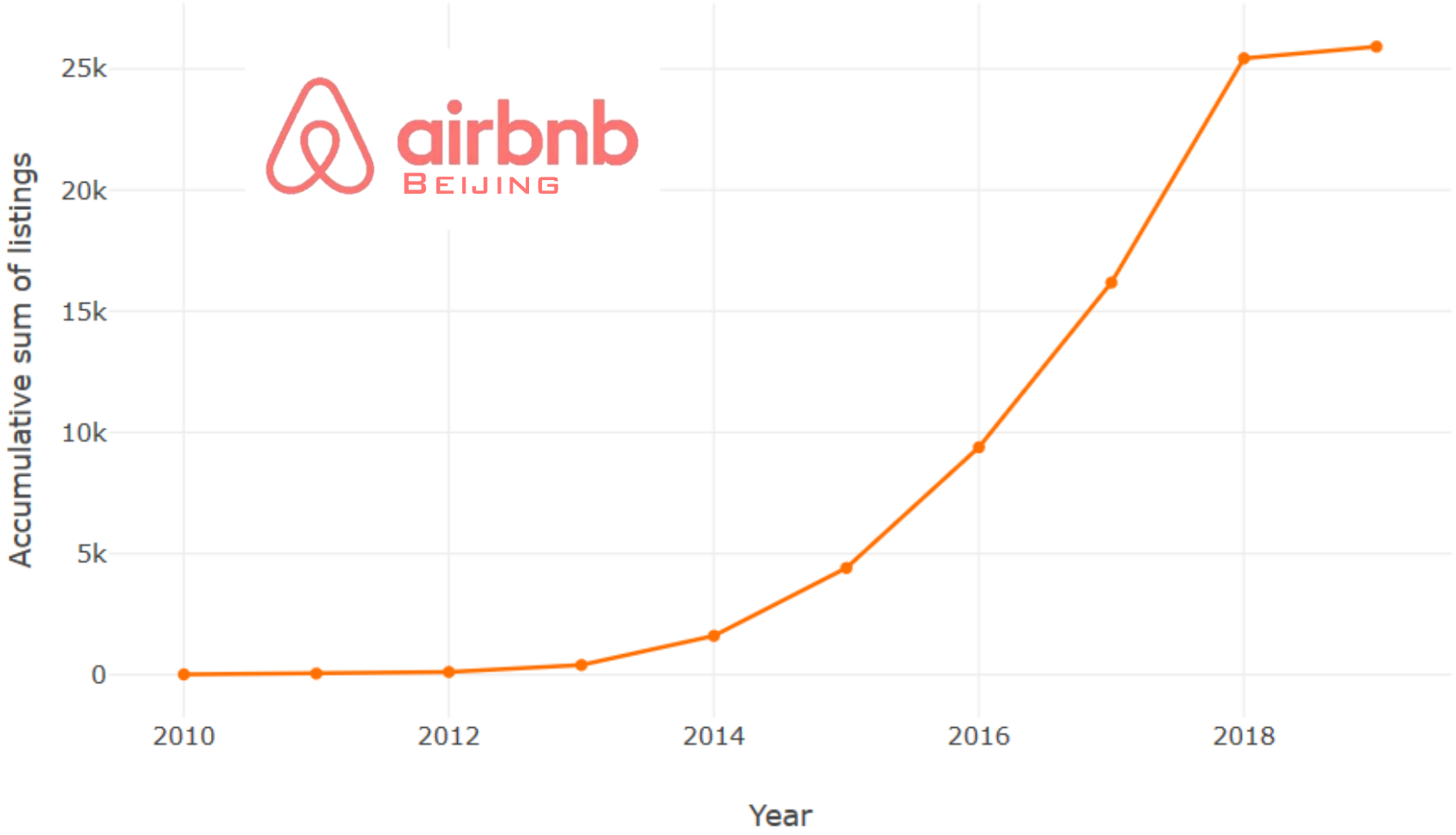


Figure 1 Accumulative number of listings year by year since 2010 in Airbnb Beijing

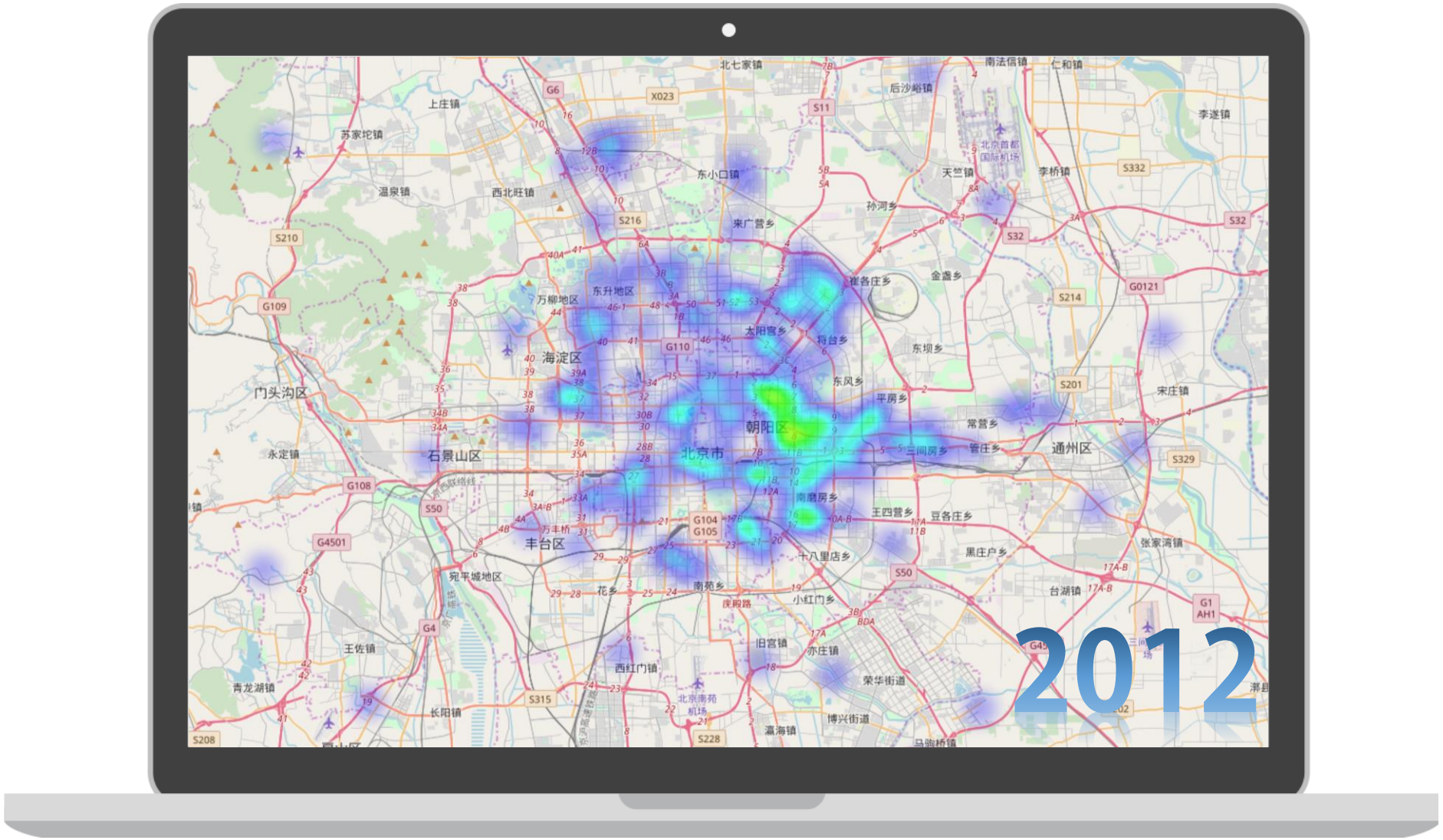
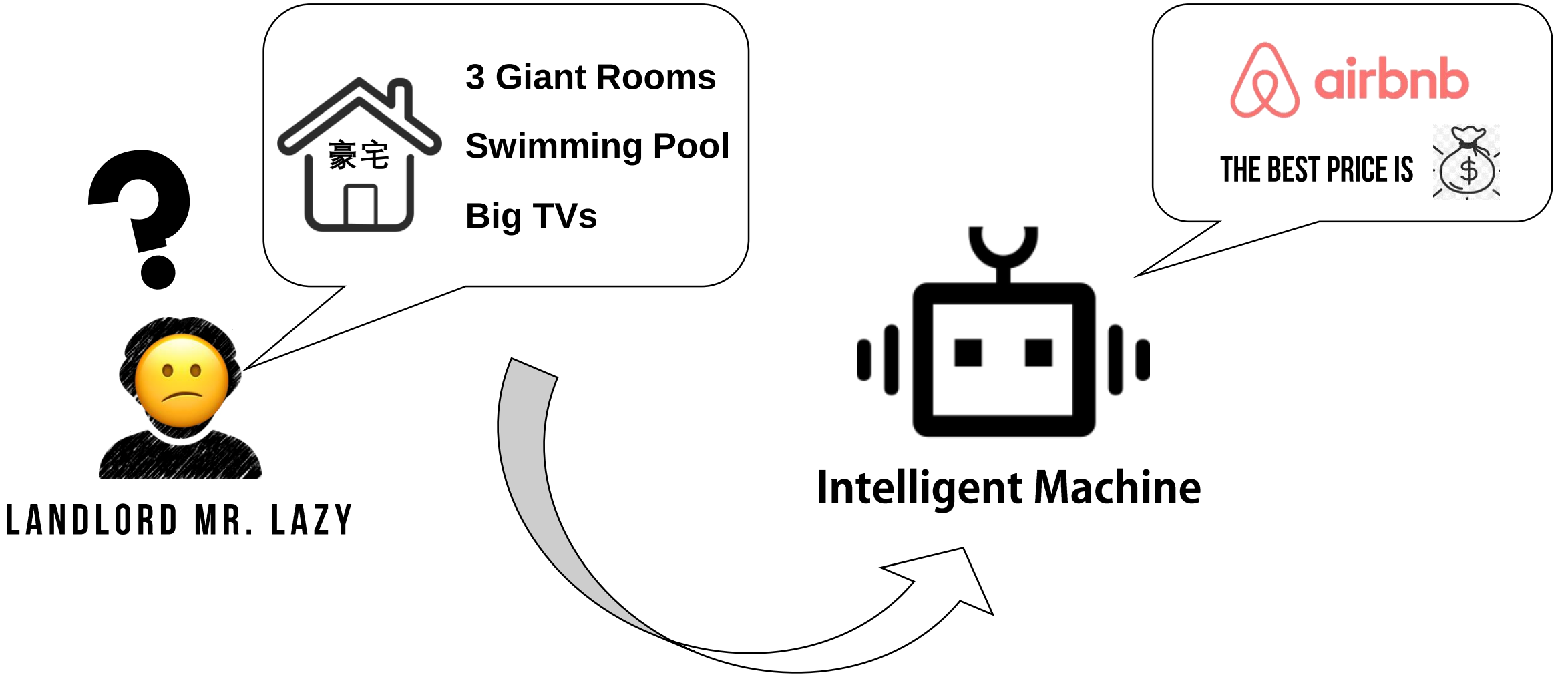


Figure 2 Accumulative distribution of listings in Year 2012

Figure 3 Accumulative distribution of listings in Year 2019


豪宅
3 Giant Rooms
Swimming Pool
Big TVs
LANDLORD MR. LAZY
airbnb
THE BEST PRICE IS
Intelligent Machine

Problem Definition

Problem Statement

Given a series of data describes the property's features

Output the reasonable/best price point for the host.

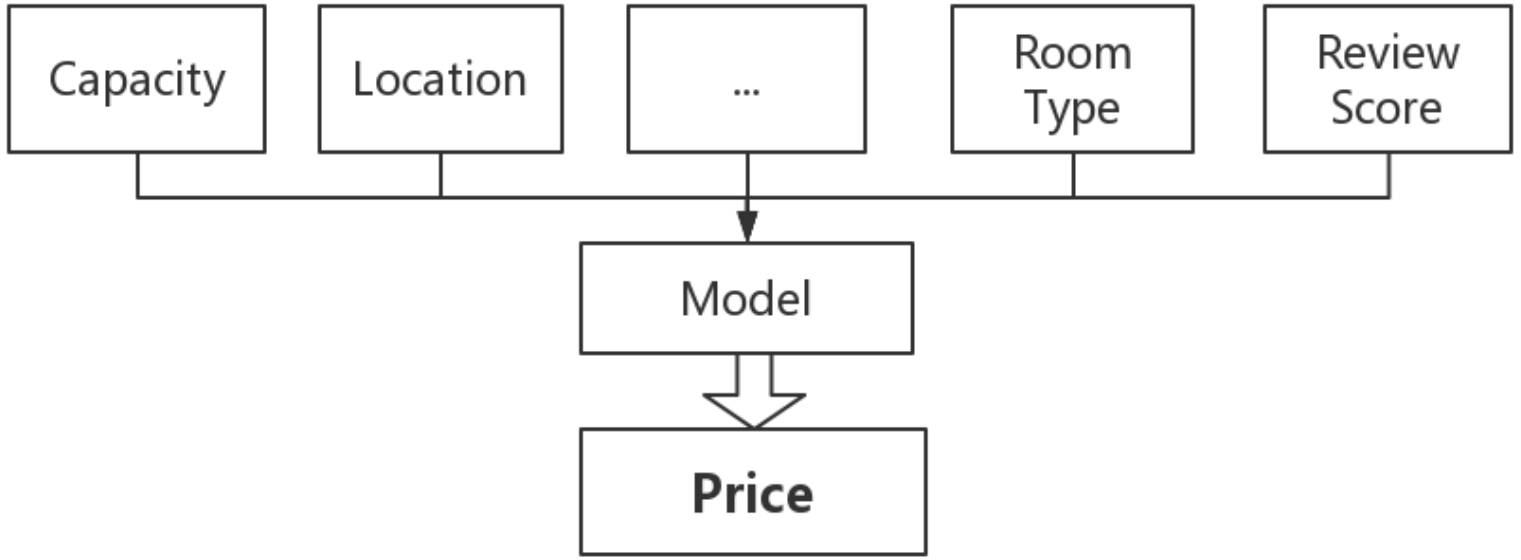


Figure 4 Problem Basic Solving Method

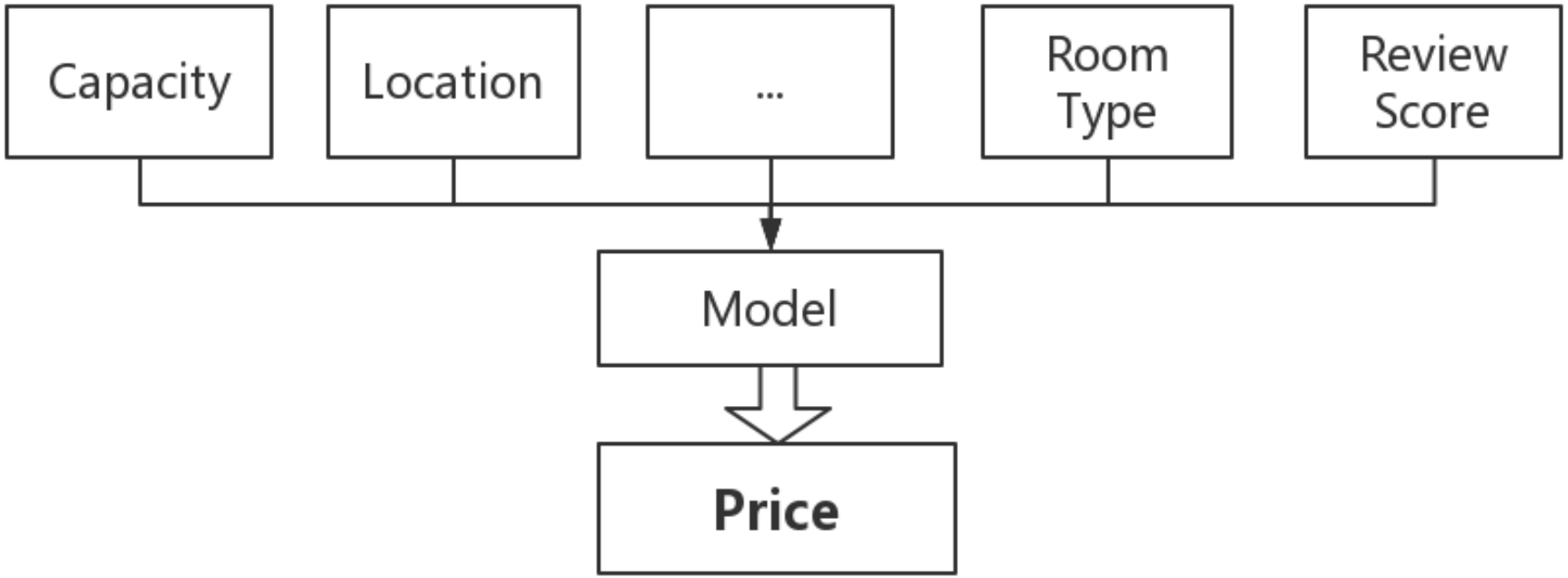


Figure 4 Problem Basic Solving Method

$$f(Capacity, Location, \dots, RoomType, ReviewScore) + \beta_0 \Rightarrow Price$$

State-of-the-Art

Table 1 A brief review of the literature on price influencing factors

Dimension	Factors	Effects	Author
External	Price in cities	N/A	Stephen and Andrew(2016)
	Number of owners Distance between owners	Pos/Neg	Balaguer and Pernias(2013), Becerra(2013)
Location	Distance	Negative	Bull(1994), Wang & Nicolau(2017), Li (2016), Huang(2010)
House	Room type	Negative	Wang & Nicolau(2017), Zhang(2017)
	Room type	Positive	
Room	Bedroom, bathroom, bed	Positive	
Rule	Instant bookable	Negative	
	Cancellation policy	Positive	
Sociality	Number of reviews per year	Negative	Wang & Nicolau(2017), Zhang(2017)
		Positive	Zhu Lv(2017), Gutt & Herrmann(2015)
	Host identity verified	Pos/Neg	Wang & Nicolau(2017)
		Positive	Zhu Lv(2017)

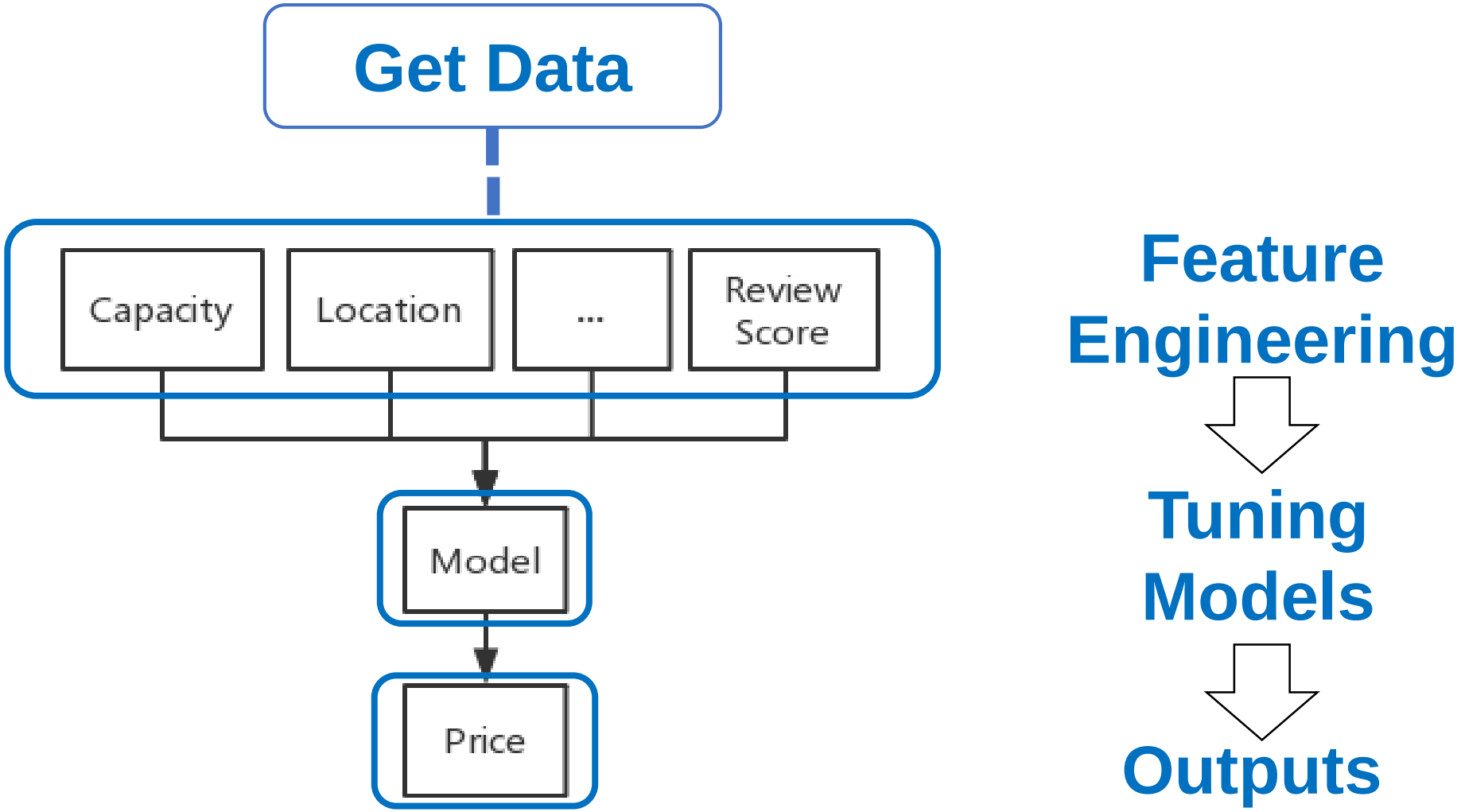


Figure 5 Problem Basic Solving Process

Methodology

Get Data

Raw_Data-Airbnb-Beijing.csv

Total:
19360 Listings

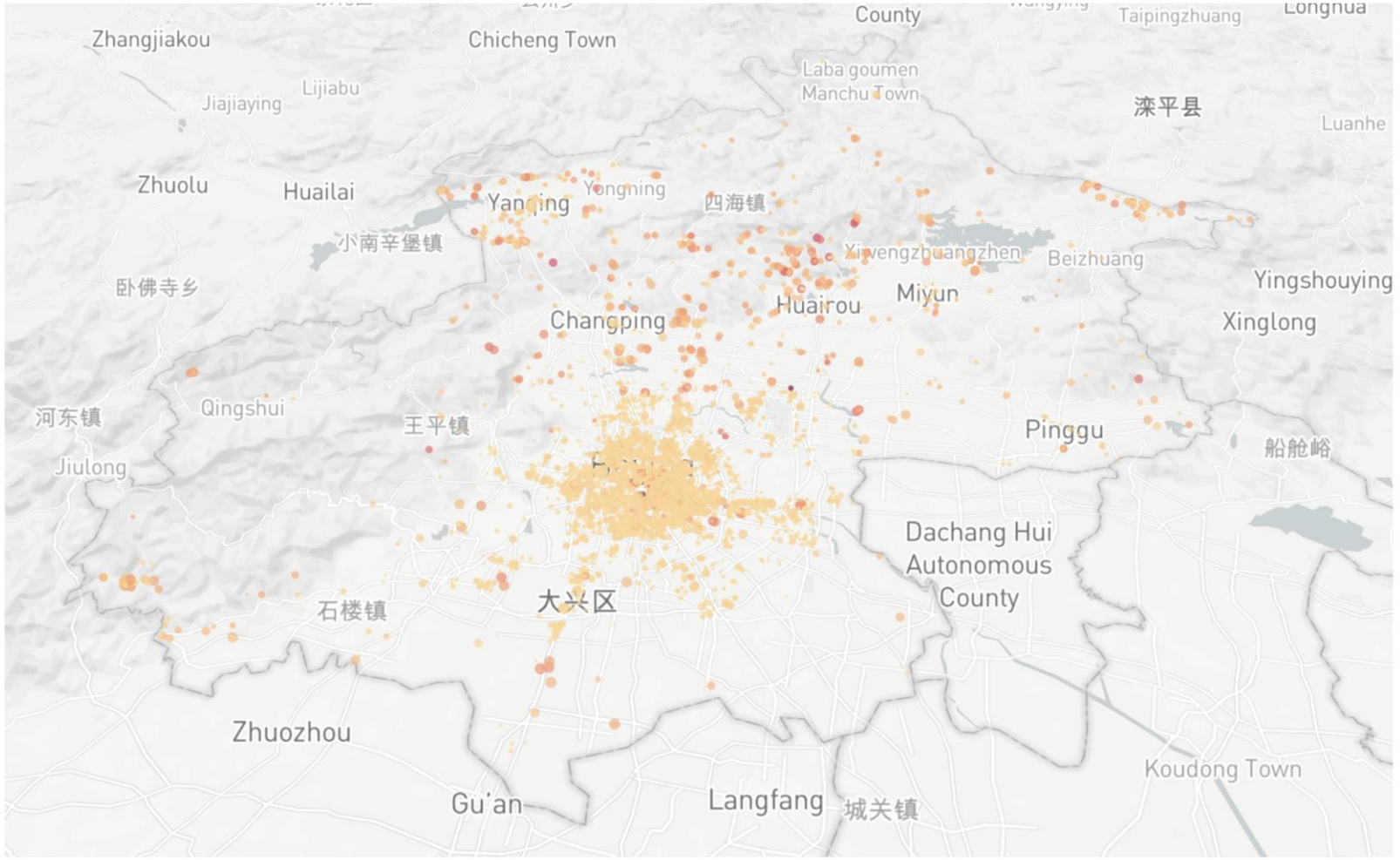


Figure 6 All available Data in Airbnb

Data Pre-Processing

- Drop Properties that lacks too many features (less than 100)
- Drop outliers handpicked via inspection (i.e. Check the Actual ID on www.airbnb.com)
- Drop Properties with unreasonable prices (i.e. the host didn't actually want to Airbnb it)

~~[Price < (50 * accommodates) OR (50 * beds)]~~

~~[Price > 20,000 OR Price = 9999]~~

~~[beds=50 OR bathrooms=101 OR min_nights > 3]~~

- Fill up a few fixable nulls.

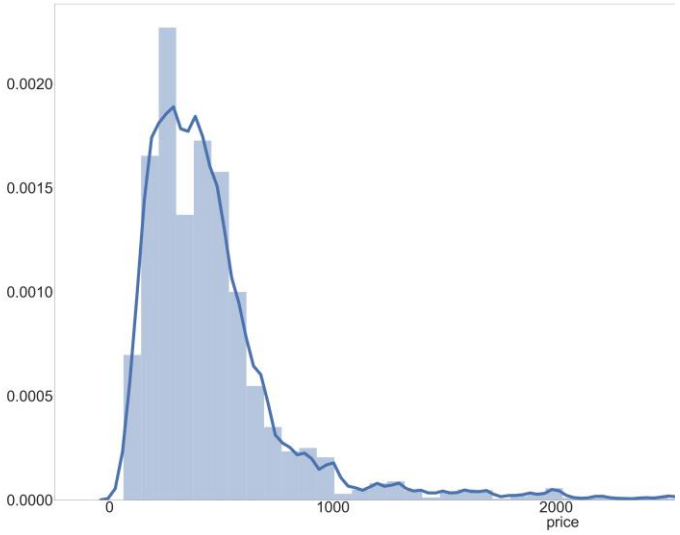
Airbnb-listings-Beijing.csv

Table 2 Pre-processed Data

ID	Capacity	Room types	Price	…
44054	9	Entire home	816	…
100213	2	Entire home	1203	…
128496	3	Private room	401	…
161902	2	Private room	387	…
162144	4	Private room	553	…
279078	2	Entire home	401	…
282825	4	Entire home	657	…
287026	3	Entire home	415	…
287511	3	Entire home	415	…
317195	2	Private room	546	…
322292	2	Entire home	436	…
…	…	…	…	…

19360 Listings → **17224 Listings**

Airbnb-listings-Beijing.csv



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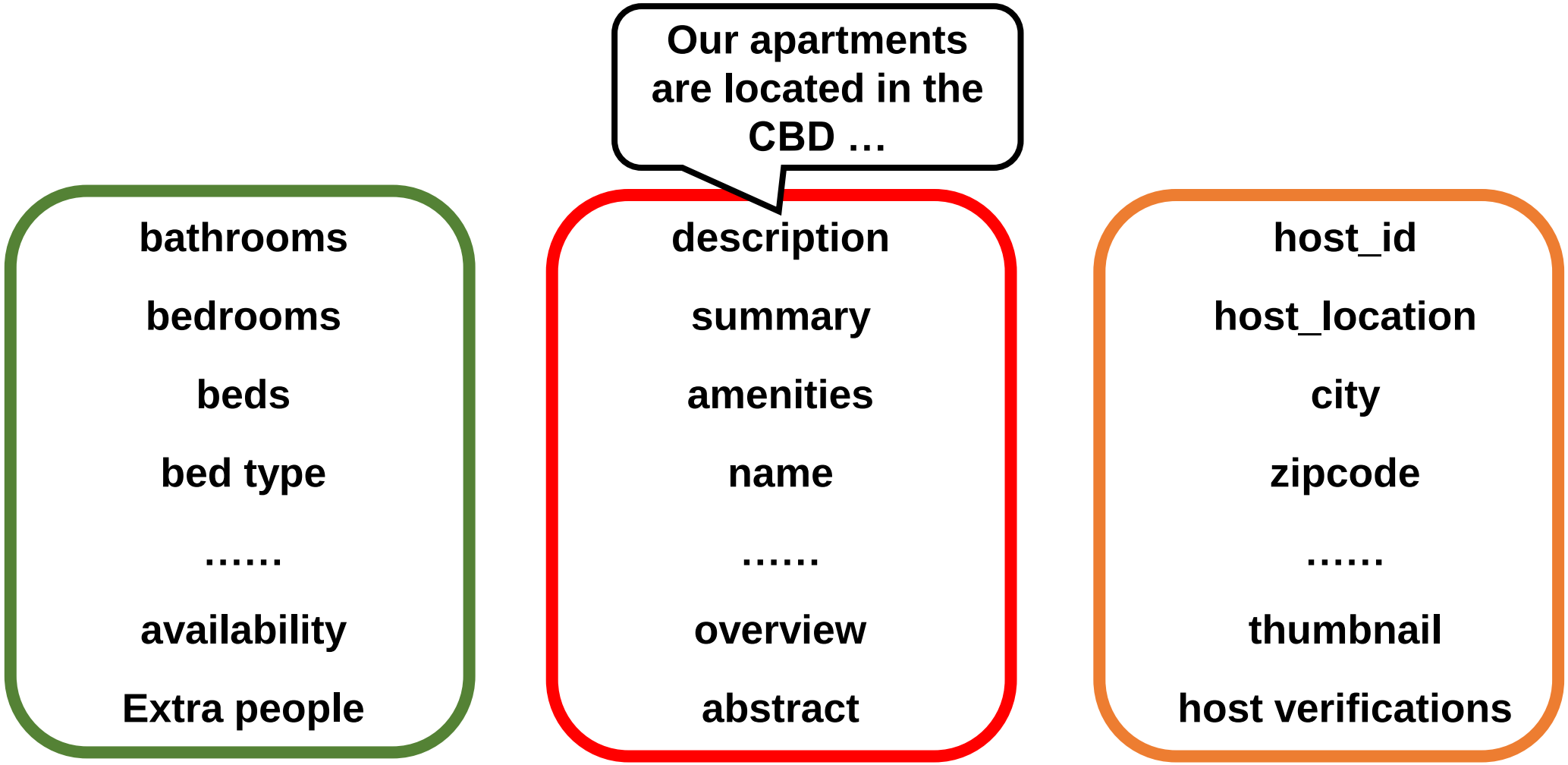
…	…	…	…	…

Total: 17224 Listings

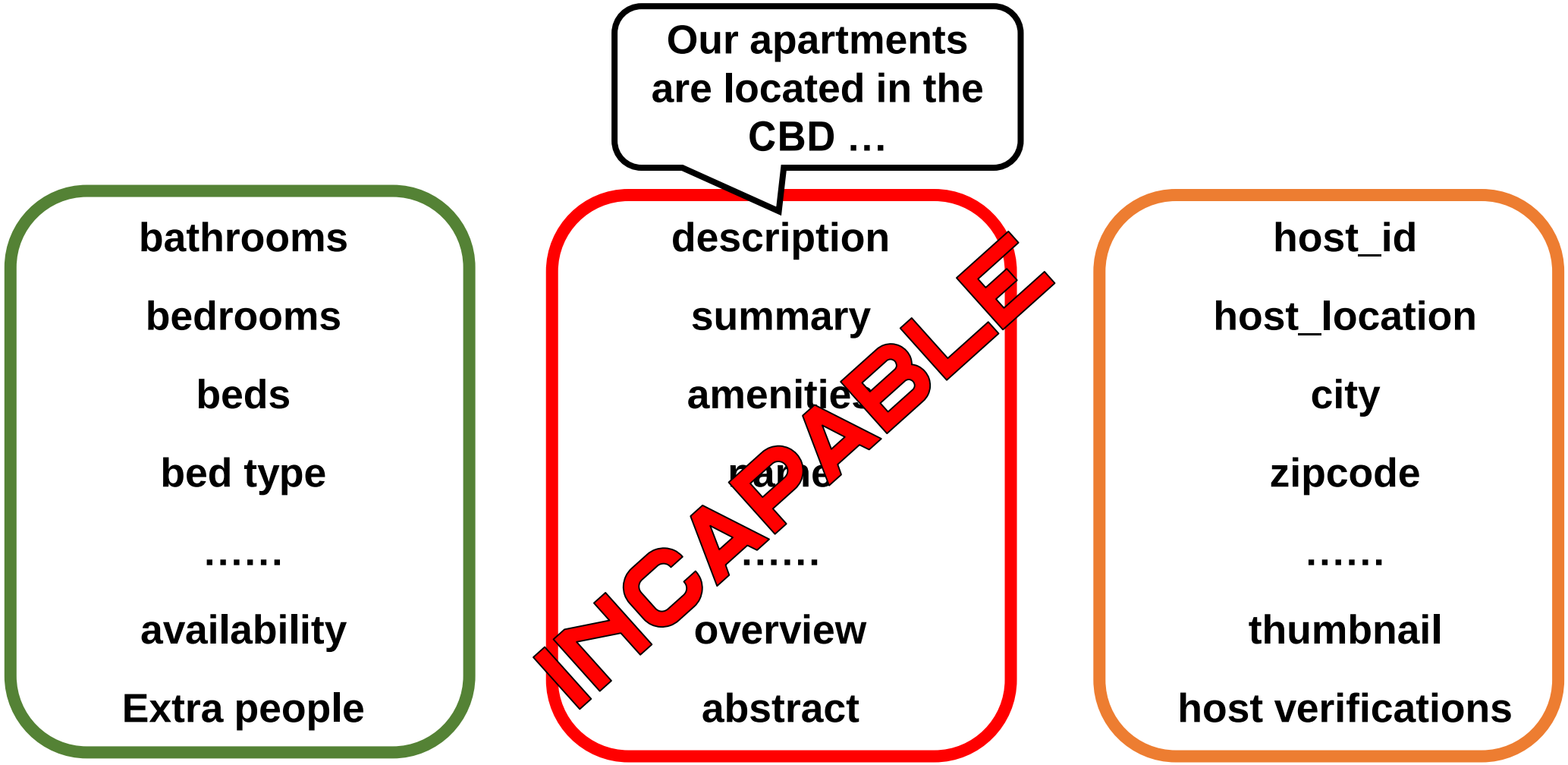
Feature Engineering

bathrooms	description	host_id
bedrooms	summary	host_location
beds	amenities	city
bed type	name	zipcode
……	……	……
availability	overview	thumbnail
Extra people	abstract	host verifications

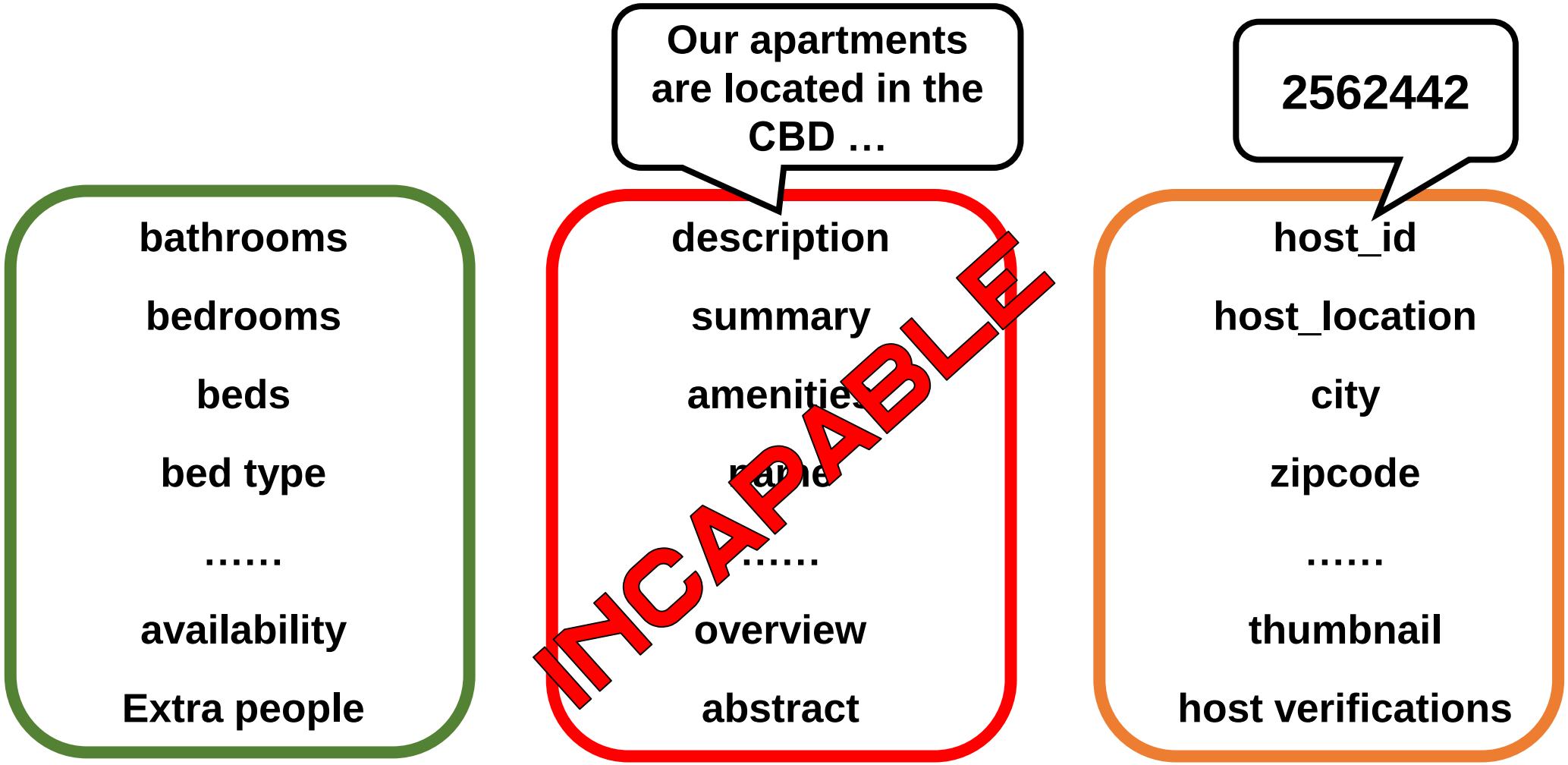
Feature Engineering



Feature Engineering



Feature Engineering



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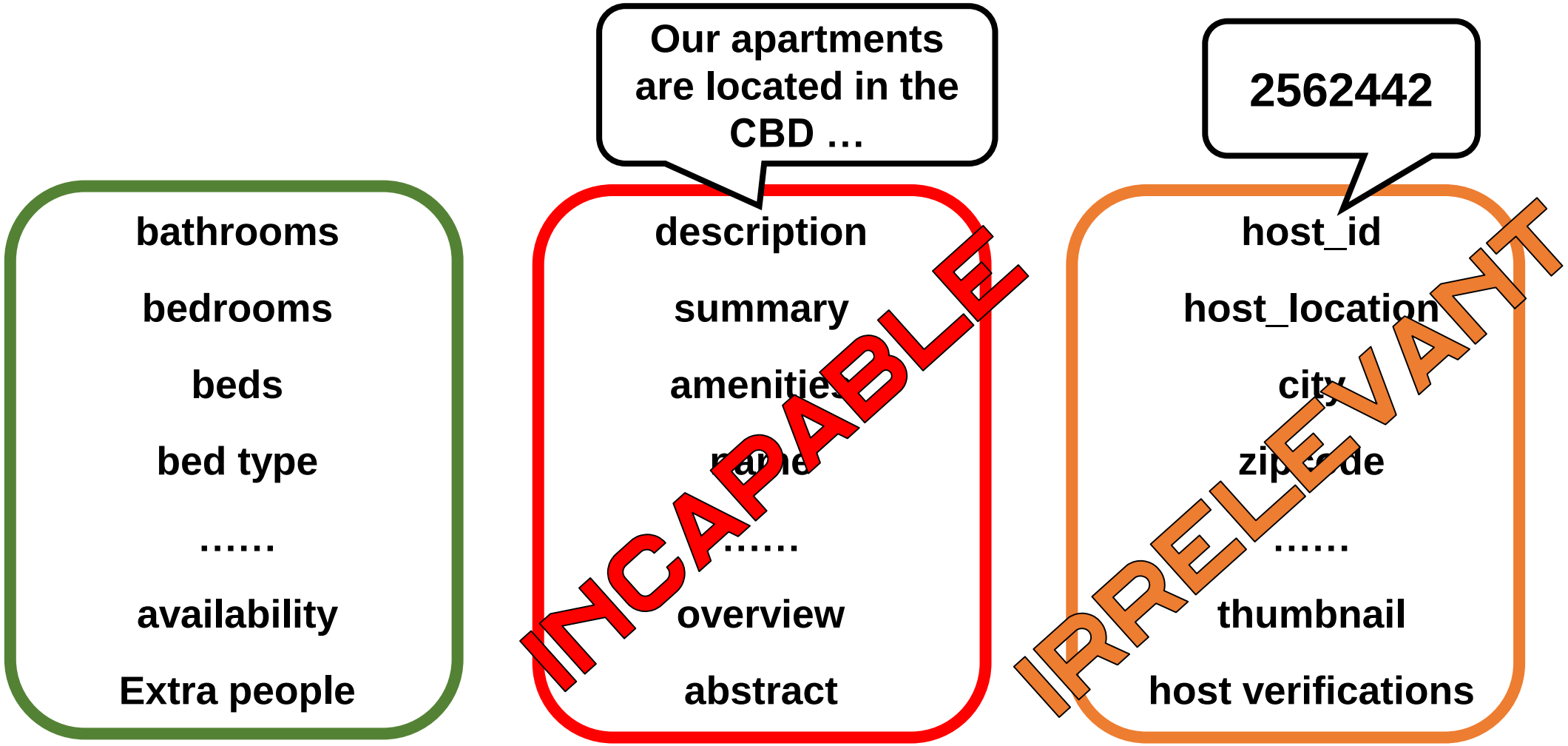


Feature Engineering

Figure 7 Hot-zone Near Beijing Railway Station

Feature Engineering

bathrooms

bedrooms

beds

bed type

……

availability

Extra people

+

Train Station

Airport

Wangjing SOHO

Yanqing IHE

……

Sanlitun

Subway

+

Feature
A / B / C

A	B	C
0	0	0
1	1	1

=

79

Features in total

Adding Features

One-Hot Encoding

accommodates

bathrooms

bedrooms

beds

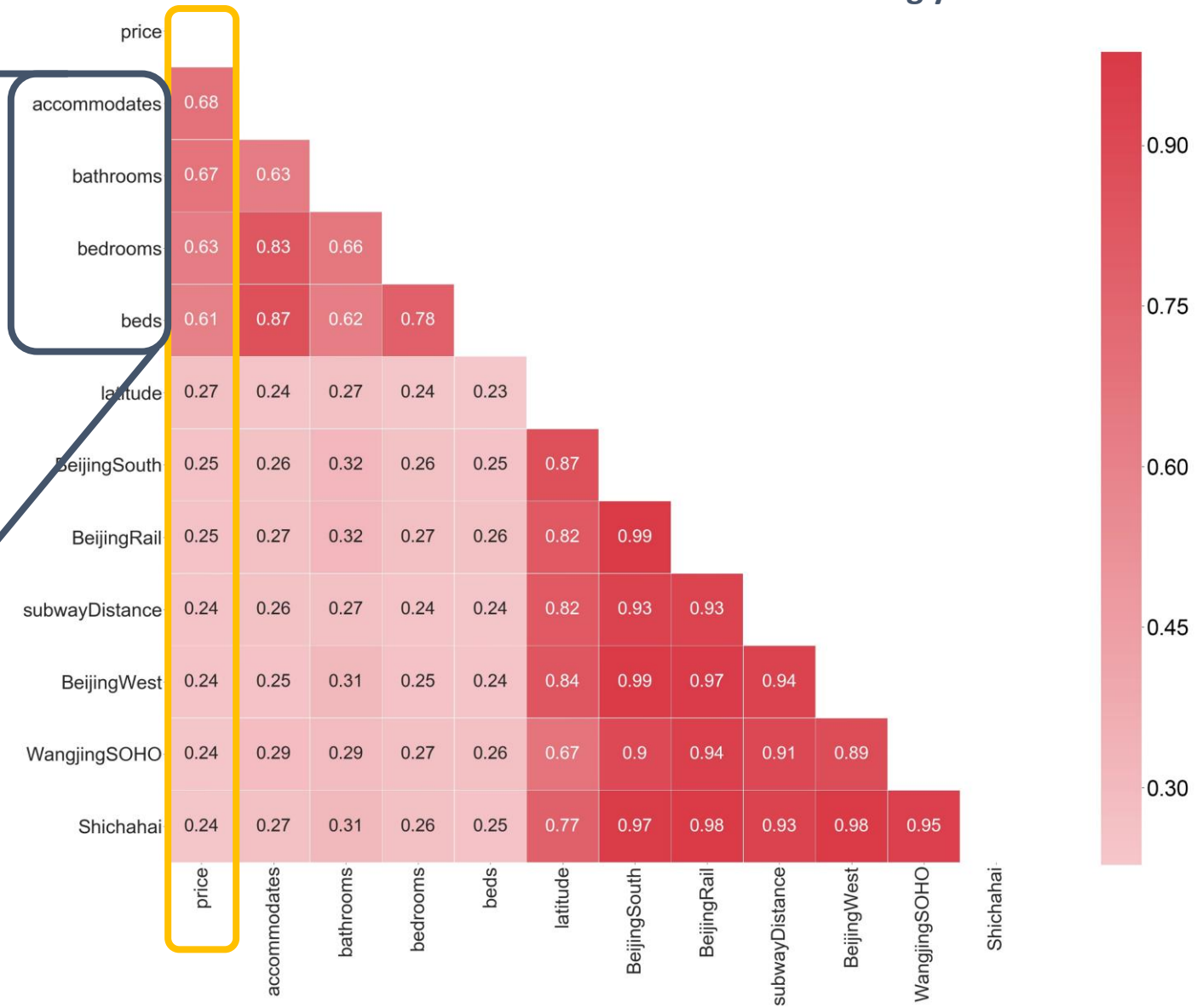


Figure 8 Correlation Coefficient Heatmap

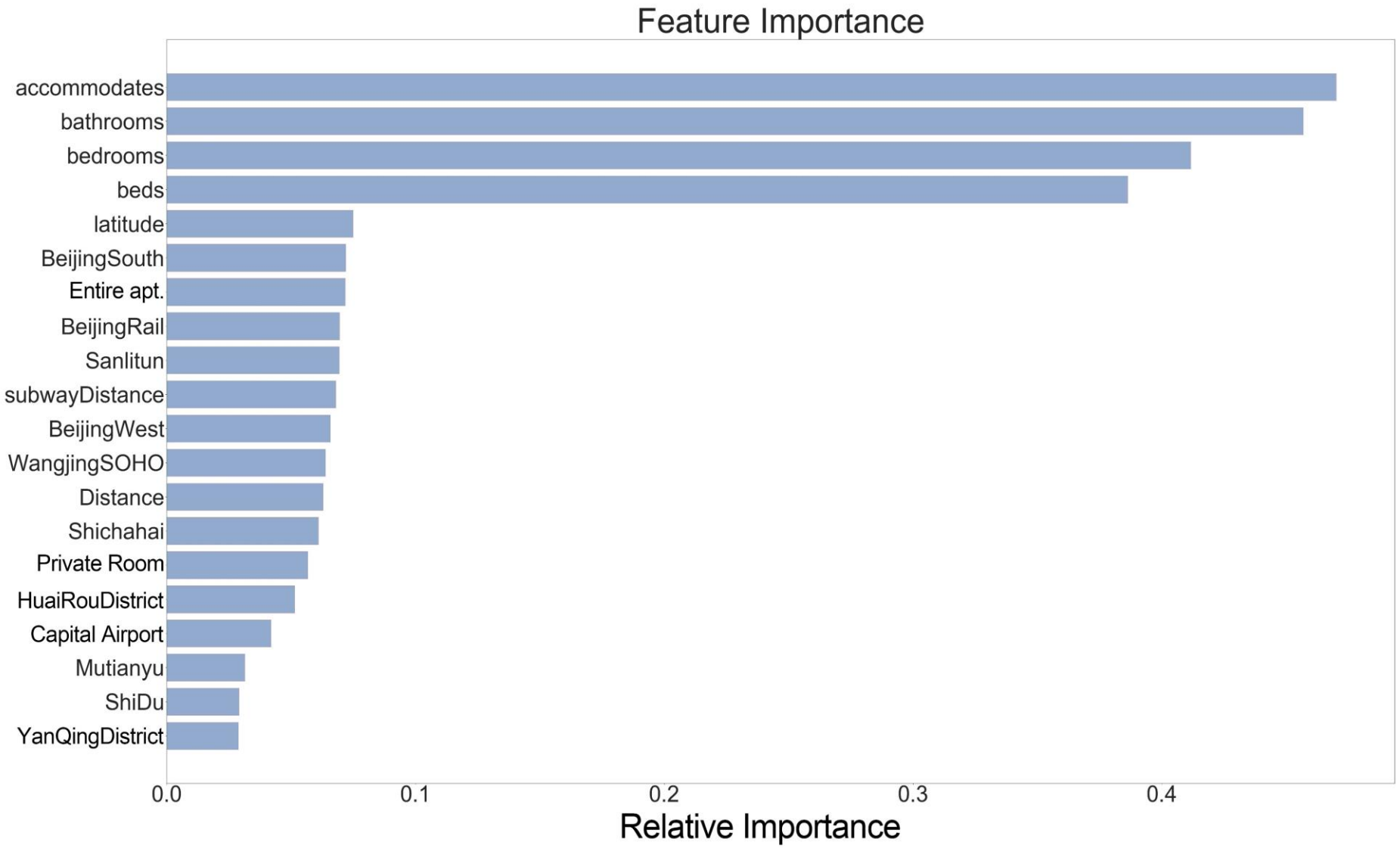


Figure 9 Feature Importance comparison

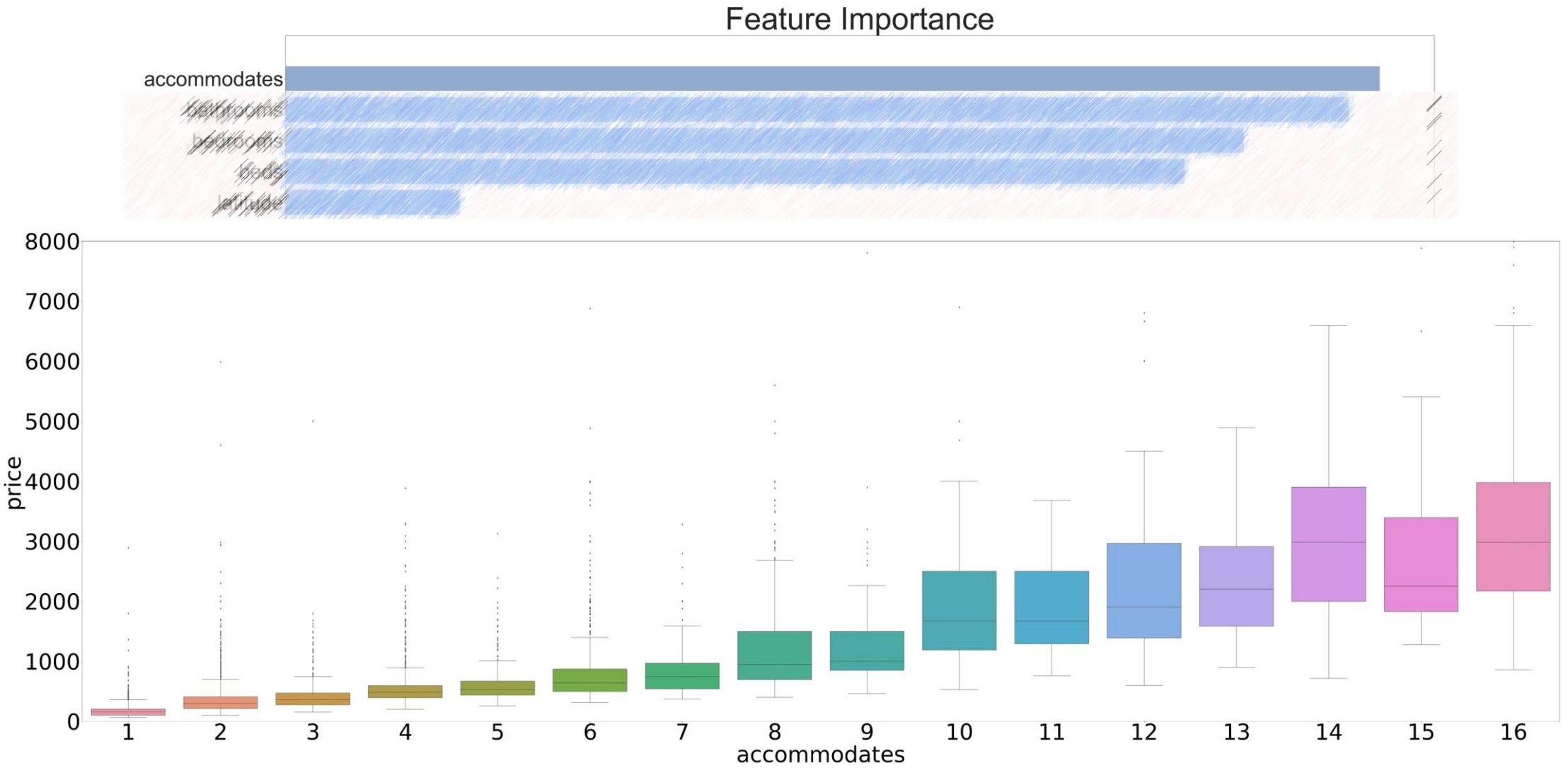
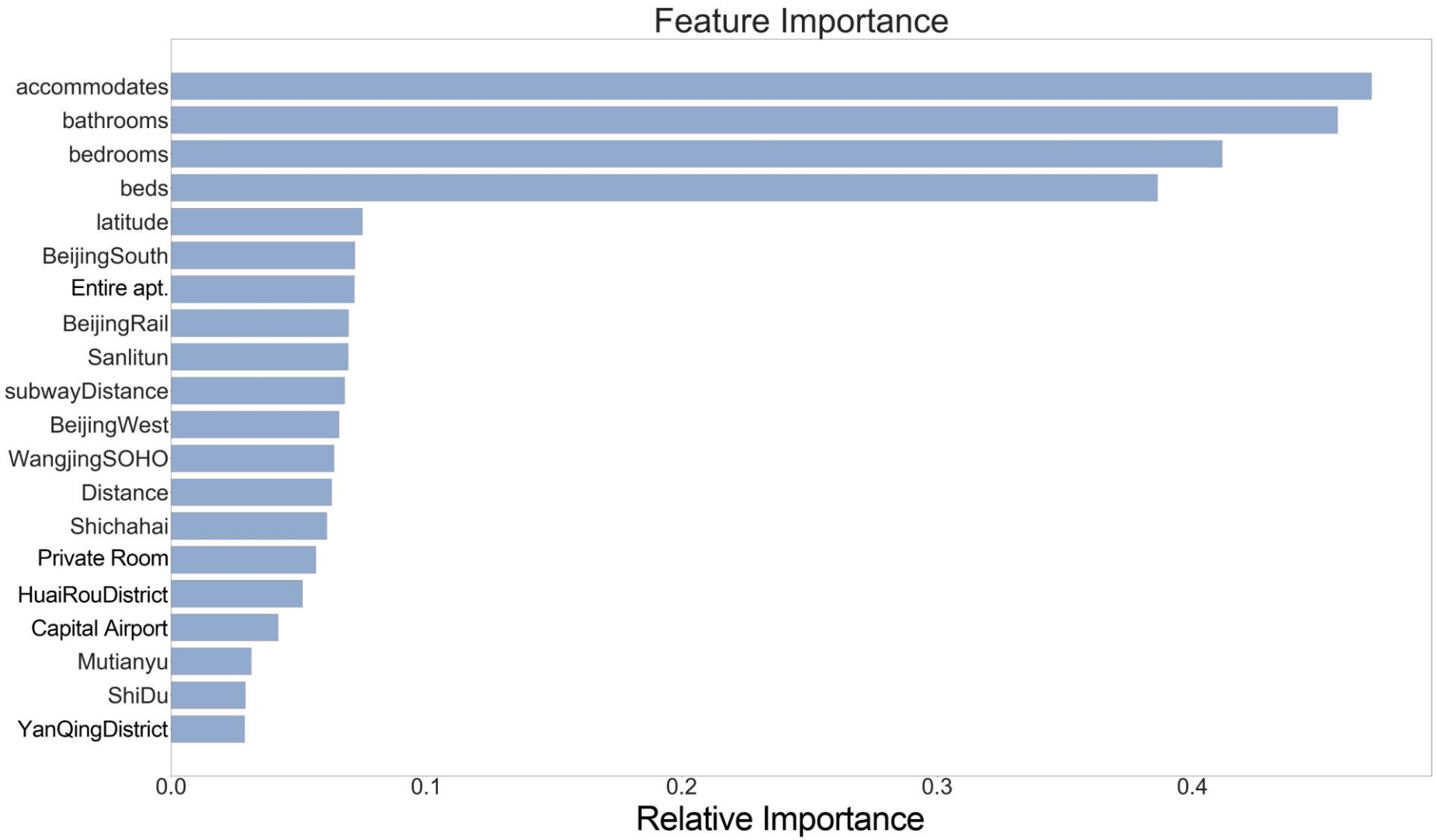


Figure 10 Accommodates-Price Box-plot



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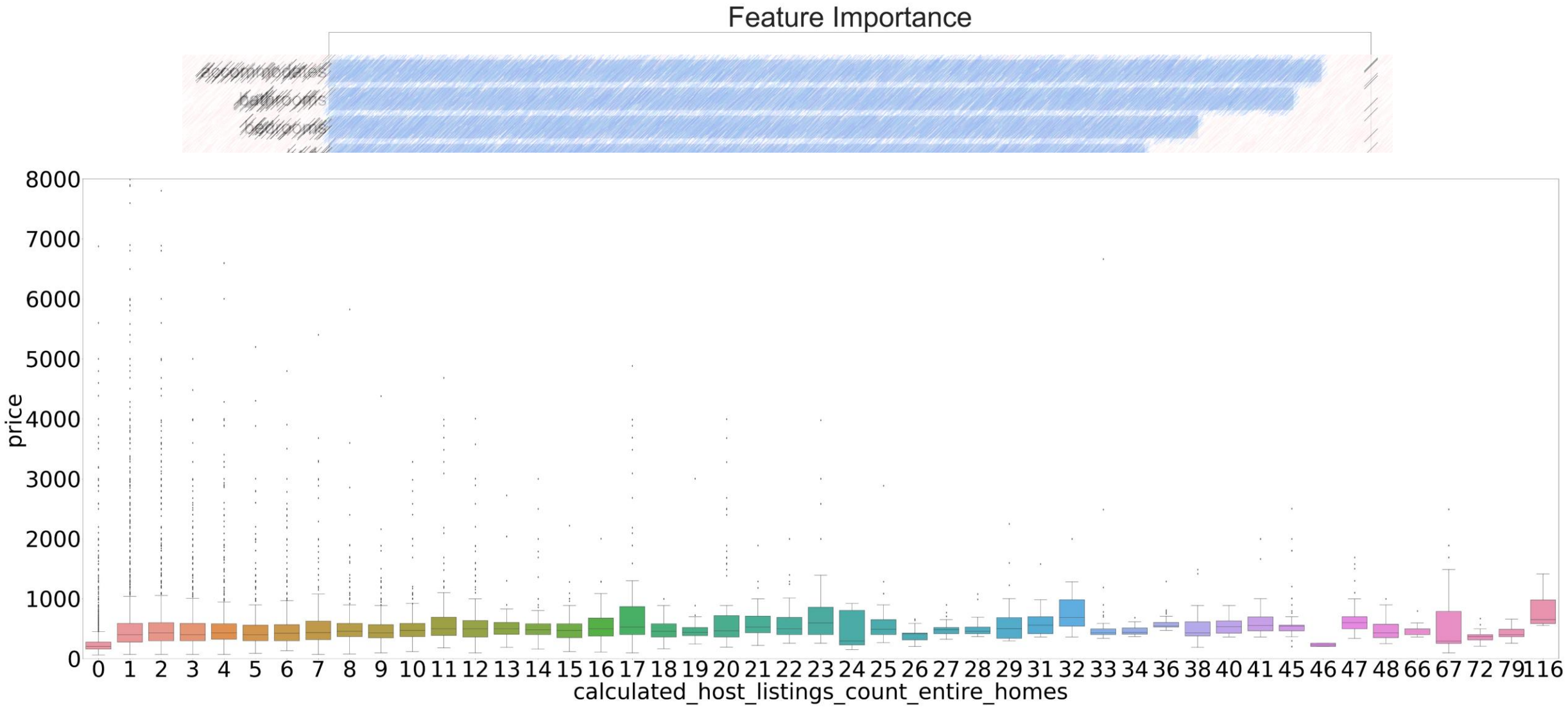
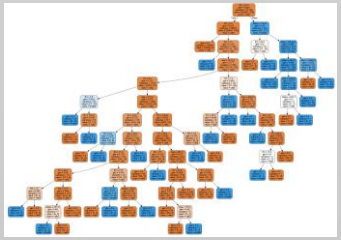
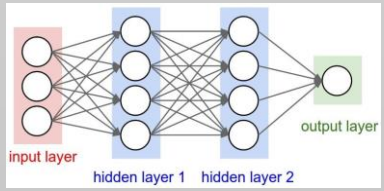


Figure 11 Host_listings-Price Box-plot

Model Building

Model





Splitted Data

Train Dataset
80 %

Test Data set
20%

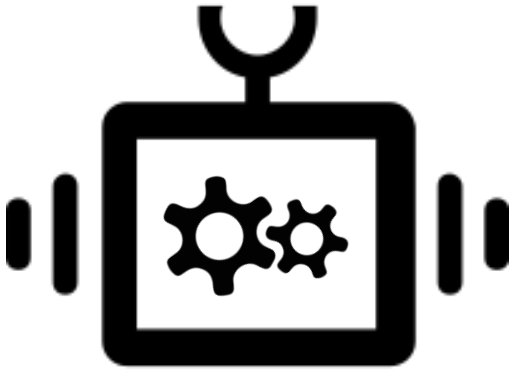
Cross Validation
Grid Search

PIPELINE

Scores

Visuals

Evaluation



Model

Train Dataset
80 %

Test Dataset
20%

Table 3 Model Results

Model Name	R^2 Score
Random Forest	0.705
Artificial Neural Network	0.712
Gradient Boosting	0.745
eXtreme Gradient Boosting	0.746

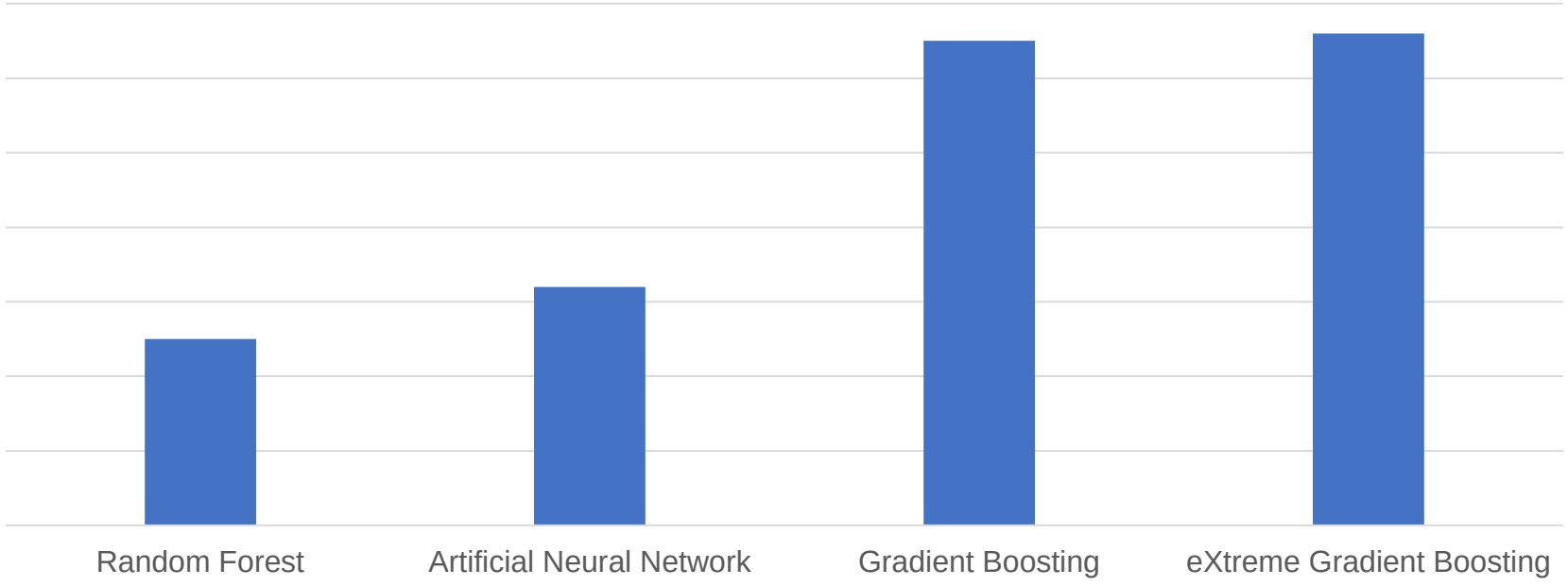


Table 3 Model Results

Model Name	R^2 Score
Random Forest	0.705
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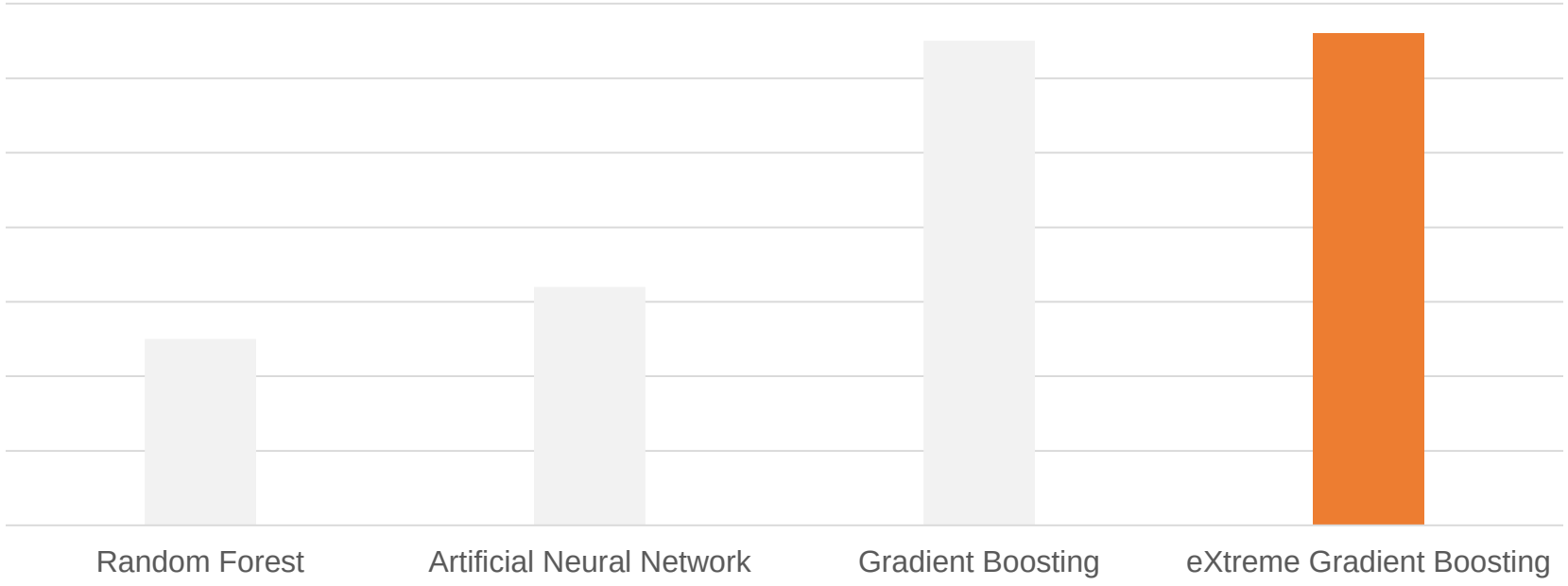


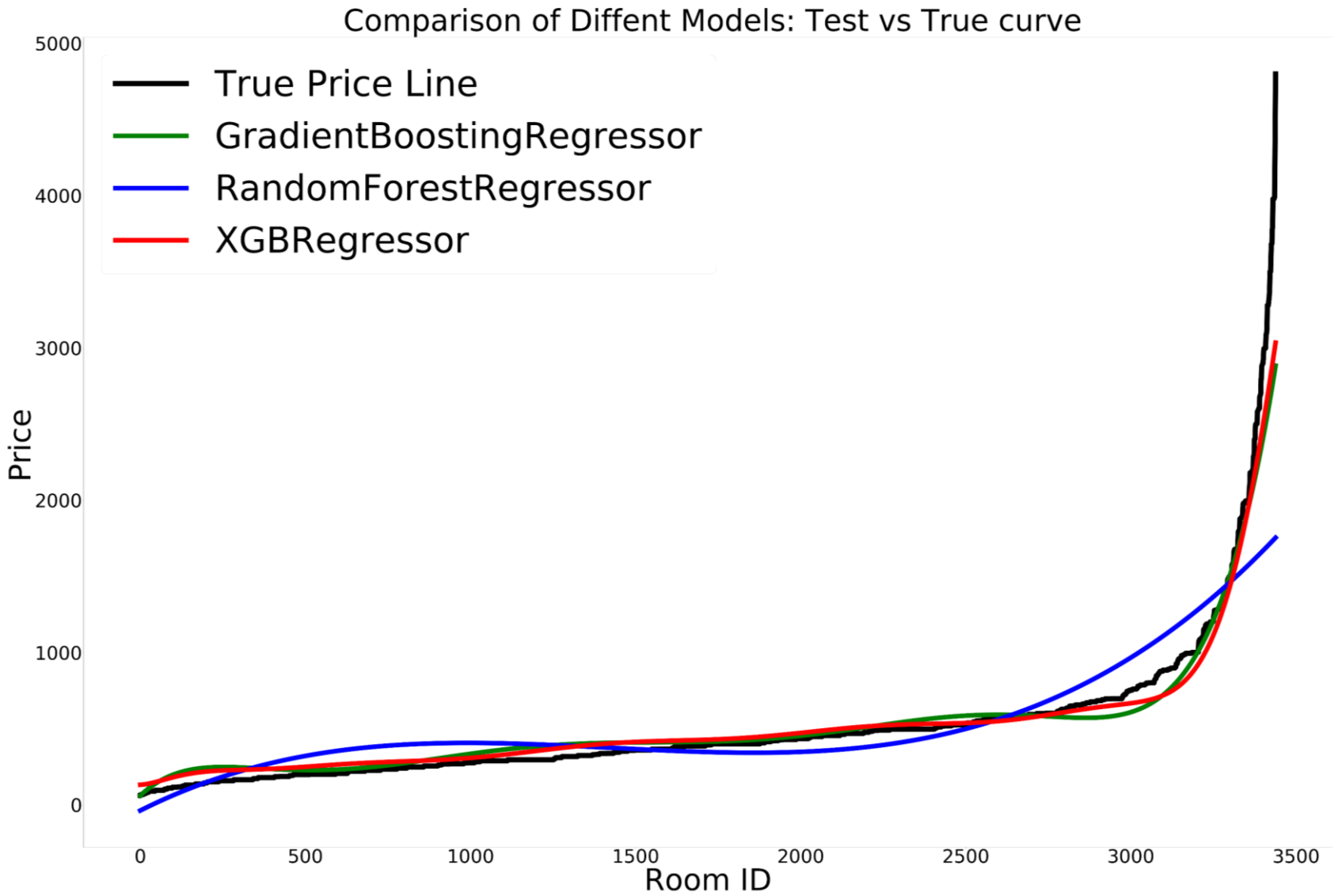


Figure 12 Comparison of Diffent Models

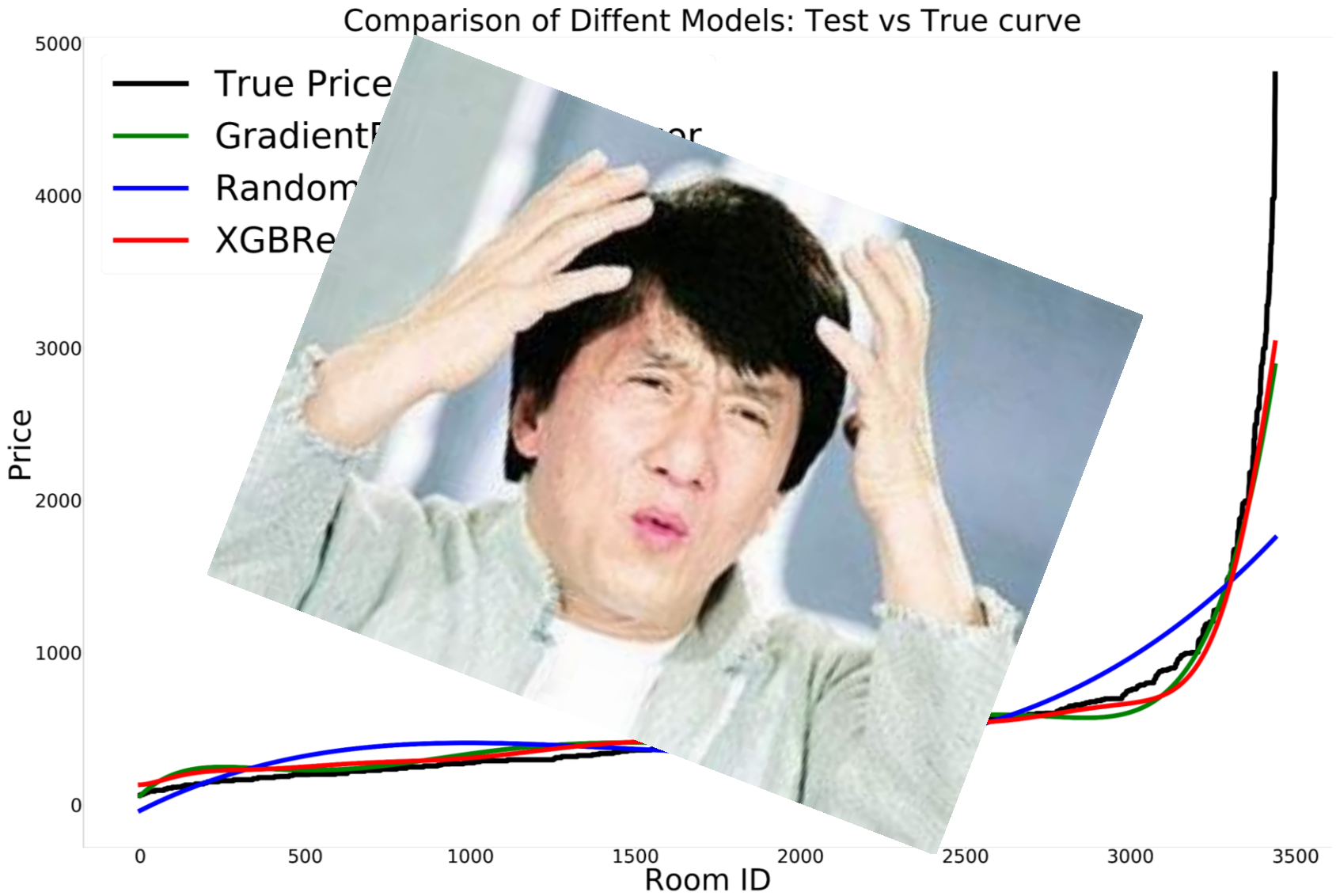


Figure 12 Comparison of Diffent Models

Table 4 Actual Performance

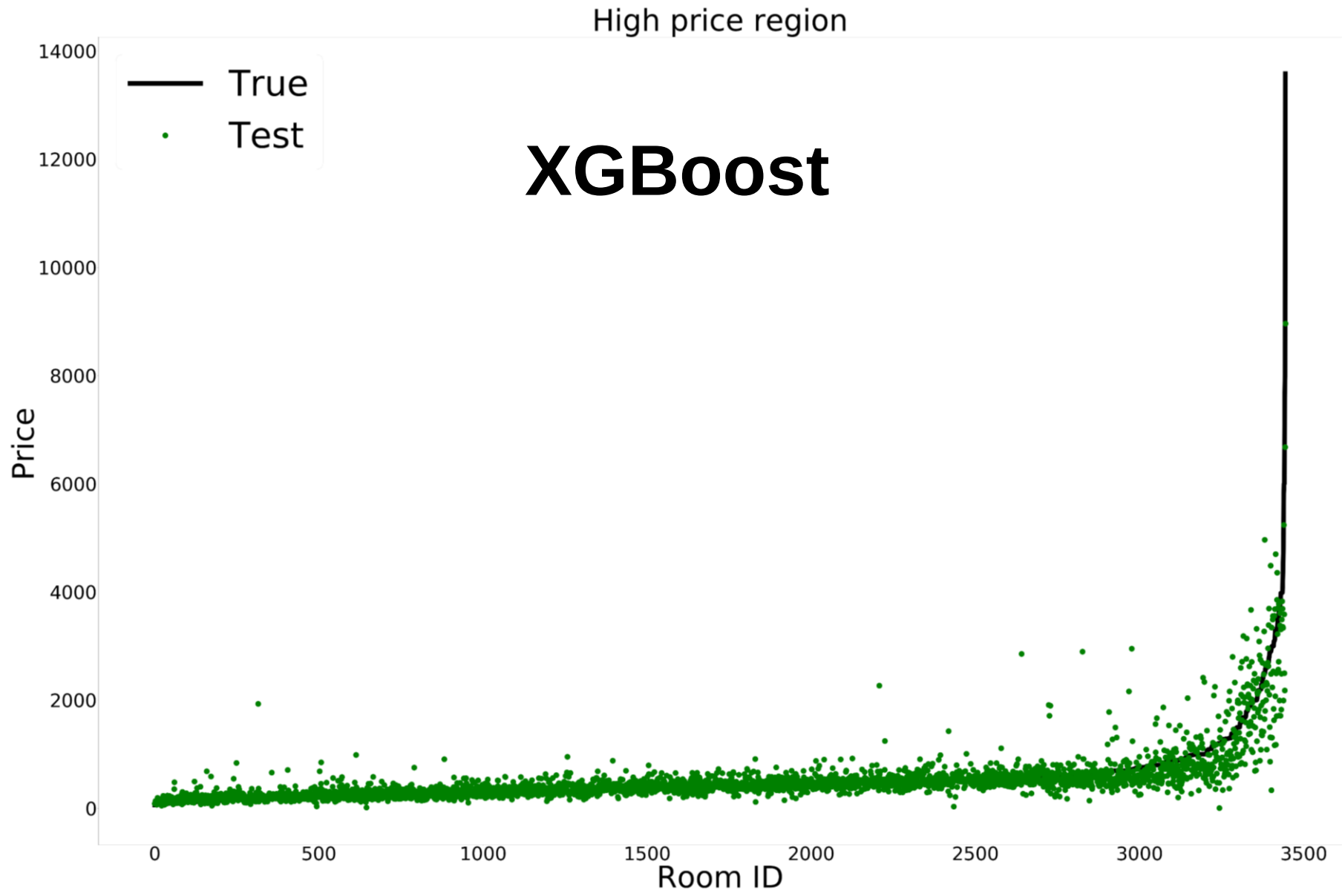
Model Name	R^2 Score	Prediction
Random Forest	0.705	¥ 1798.06
Artificial Neural Network	0.712	¥ 1820.95
Gradient Boosting	0.745	¥ 1882.24
eXtreme Gradient Boosting	**0.746**	**¥ 1887.61**

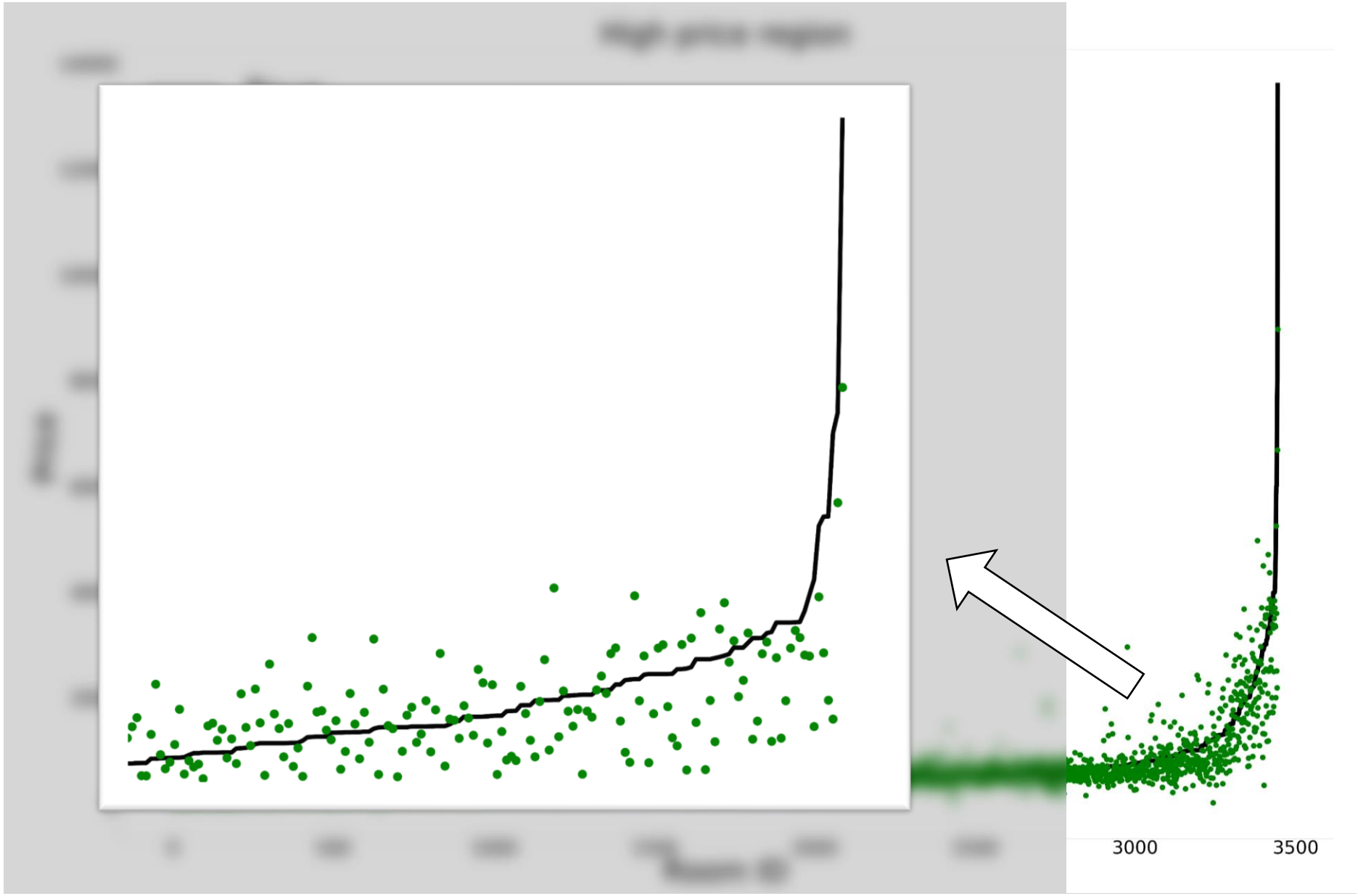
Beijing

Entire house

12 guests 6 bedrooms 6 beds 2 baths

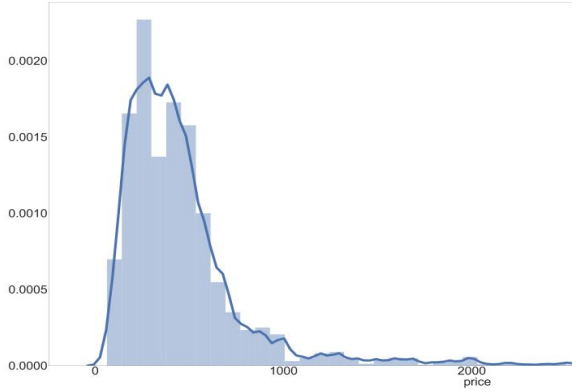
¥ 1,888 per night


High price region
True
Test
XGBoost
Price
Room ID
14000
12000
10000
8000
6000
4000
2000
0
0
500
1000
1500
2000
2500
3000
3500


3000
3500

Error Analysis

- Expensive listings have **less** data than cheap listings

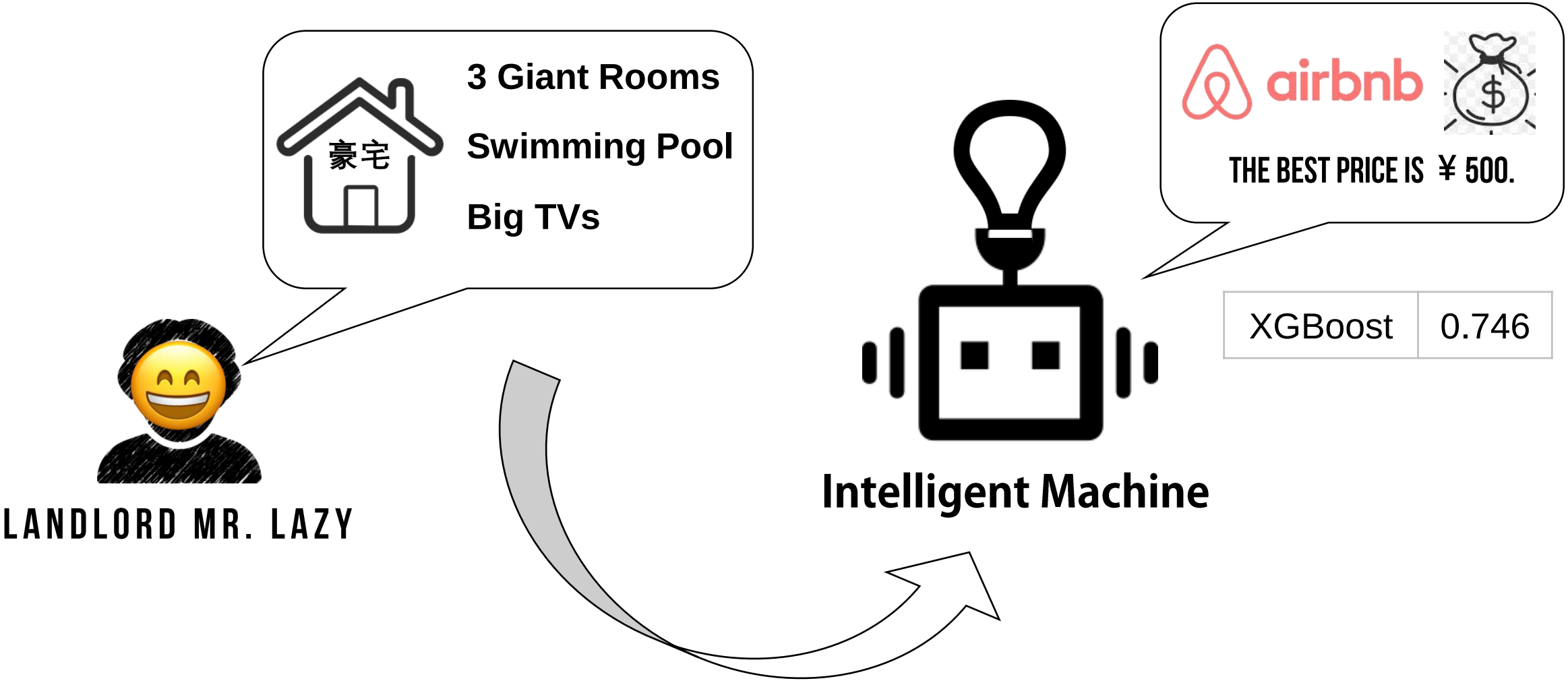


- **Feature isn't everything for price.**

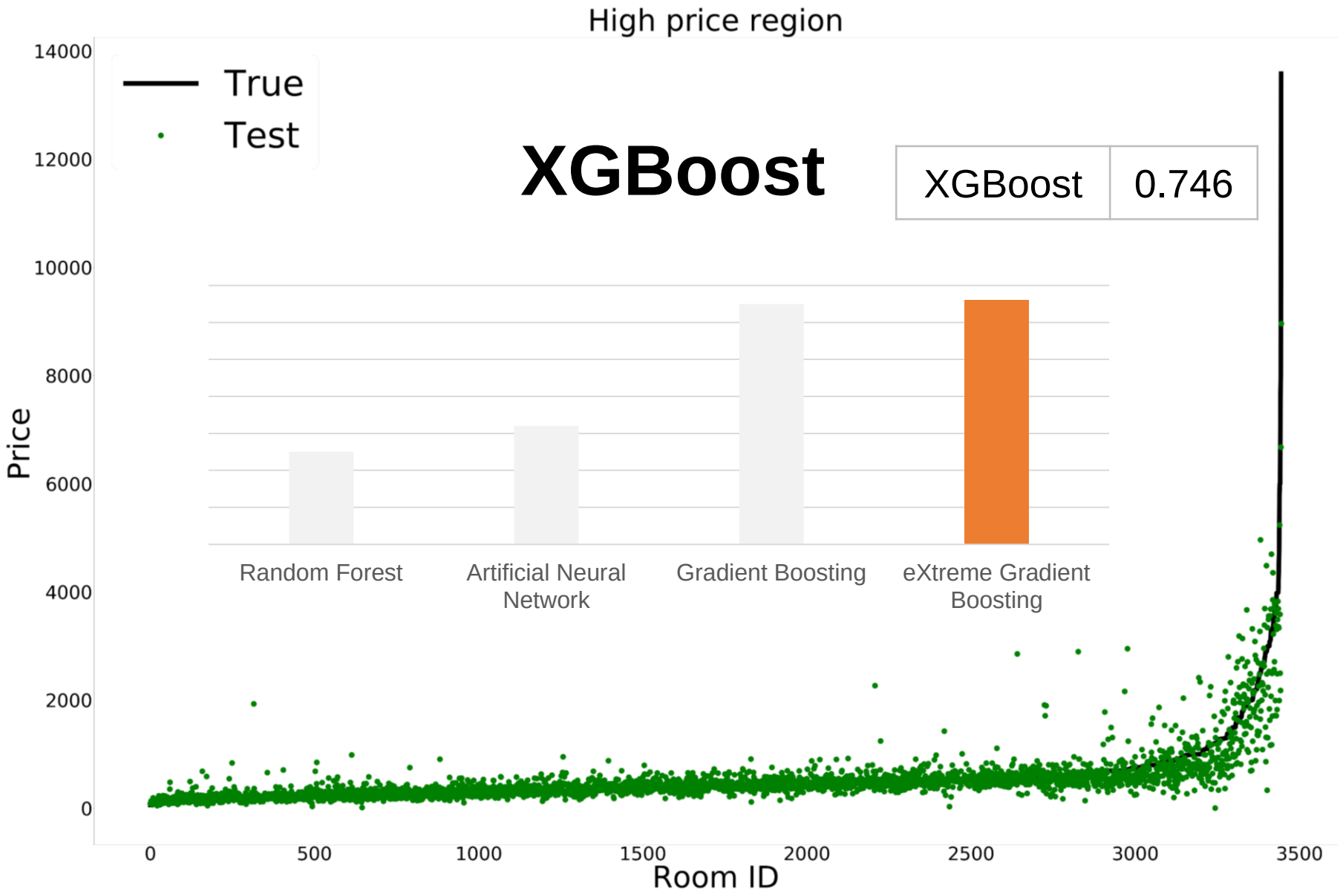
¥ 200

¥ 2348

To wrap up,



XGBoost	0.746


High price region
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Random Forest
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Gradient Boosting
eXtreme Gradient Boosting
Price
14000
12000
10000
8000
6000
4000
2000
0
0
500
1000
1500
2000
2500
3000
3500
Room ID

Thank you!

Thank you!

AI HUB 😘

Q & A