

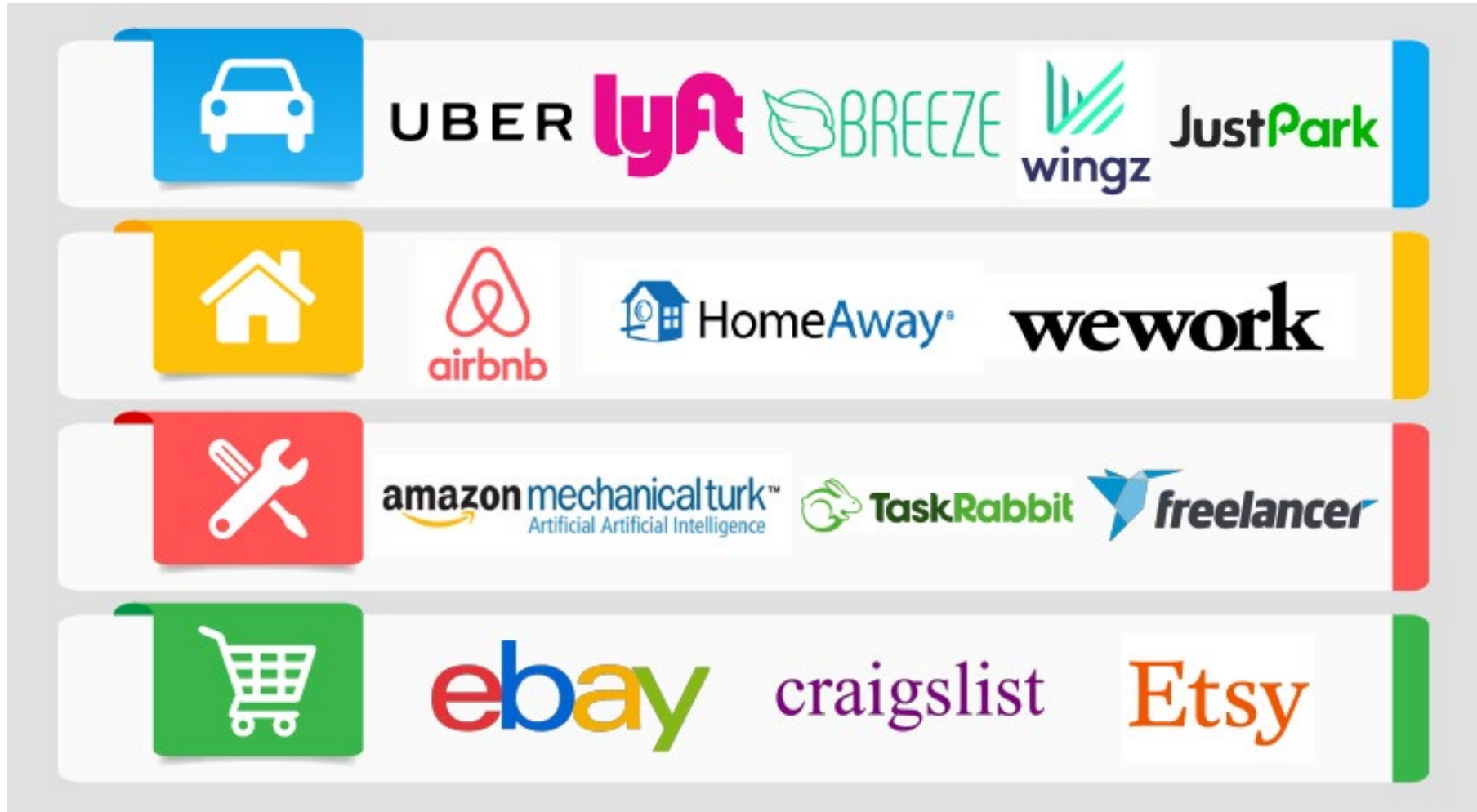
Machine Learning Application For Shared Economy Part 1

Urban Information Lab

Prof. Dr. Junfeng Jiao



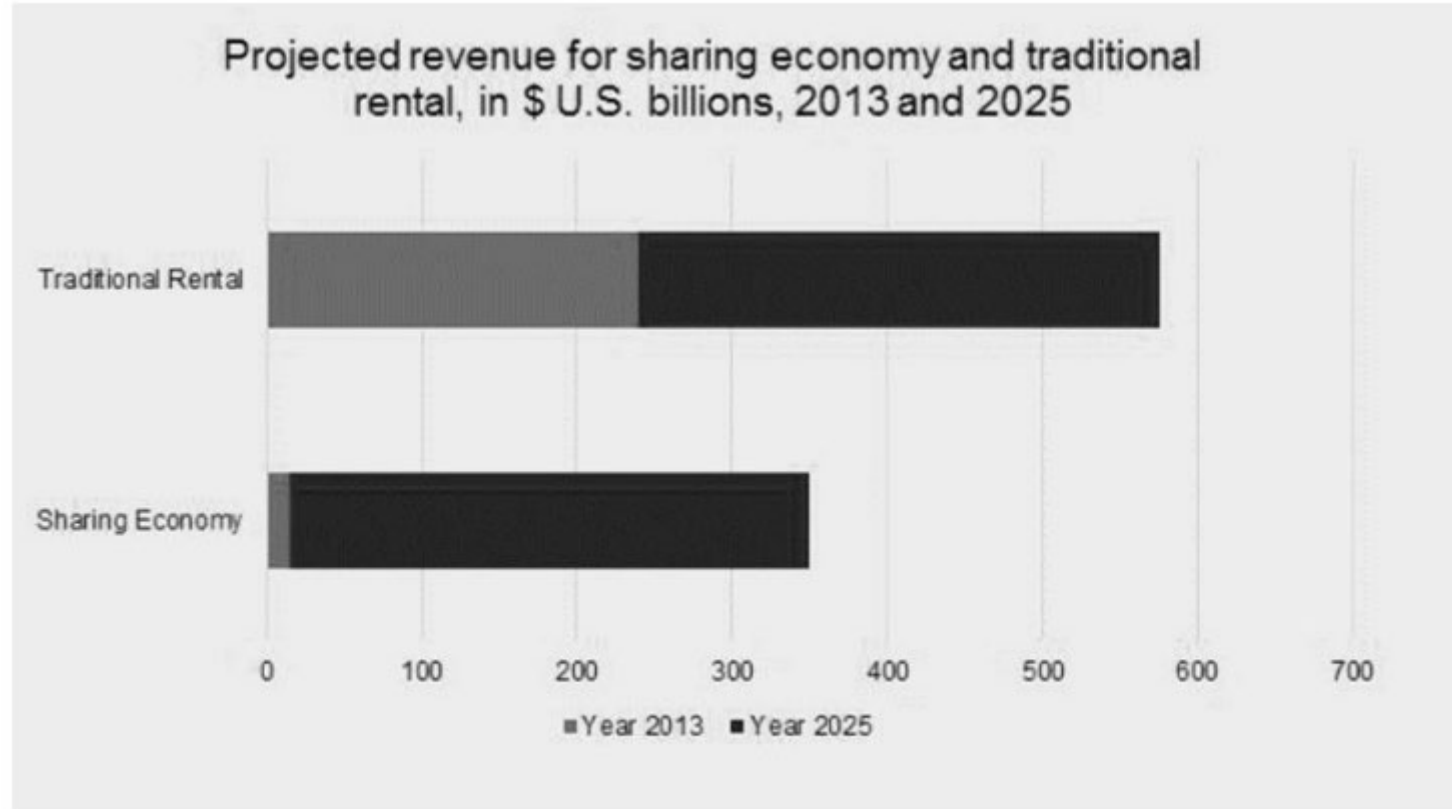
1. Background: What is Shared Economy?



1. Background: What is Shared Economy?

- The sharing economy is “the peer-to-peer based activity of obtaining, giving, or sharing access to good and services”. Alternative names for this phenomenon include gig economy, platform economy, access economy, and collaborative consumption.
- The sharing economy is estimated to grow from \$14 billion in 2014 to \$335 billion by 2025. This estimate is based on the rapid growth of Uber and Airbnb as indicative.
- Sharing data and algorithm with government is one way that sharing economy companies can build trust with regulators.

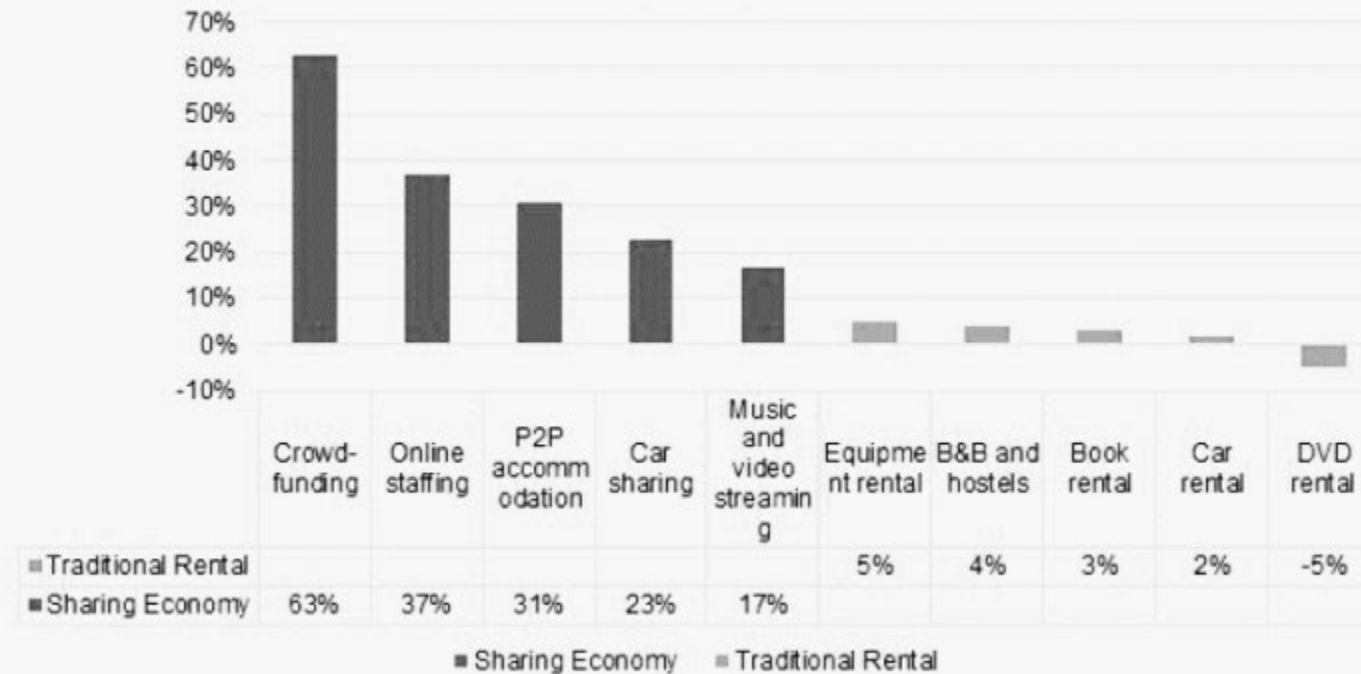
2. Future Growth



Source: "The sharing economy—sizing the revenue opportunity," (Hawksworth et al., 2014)

As the figure above shows, in the next ten years, the increase in revenues from the traditional rental industry will be modest in comparison to the explosion in revenues in the shared economy.

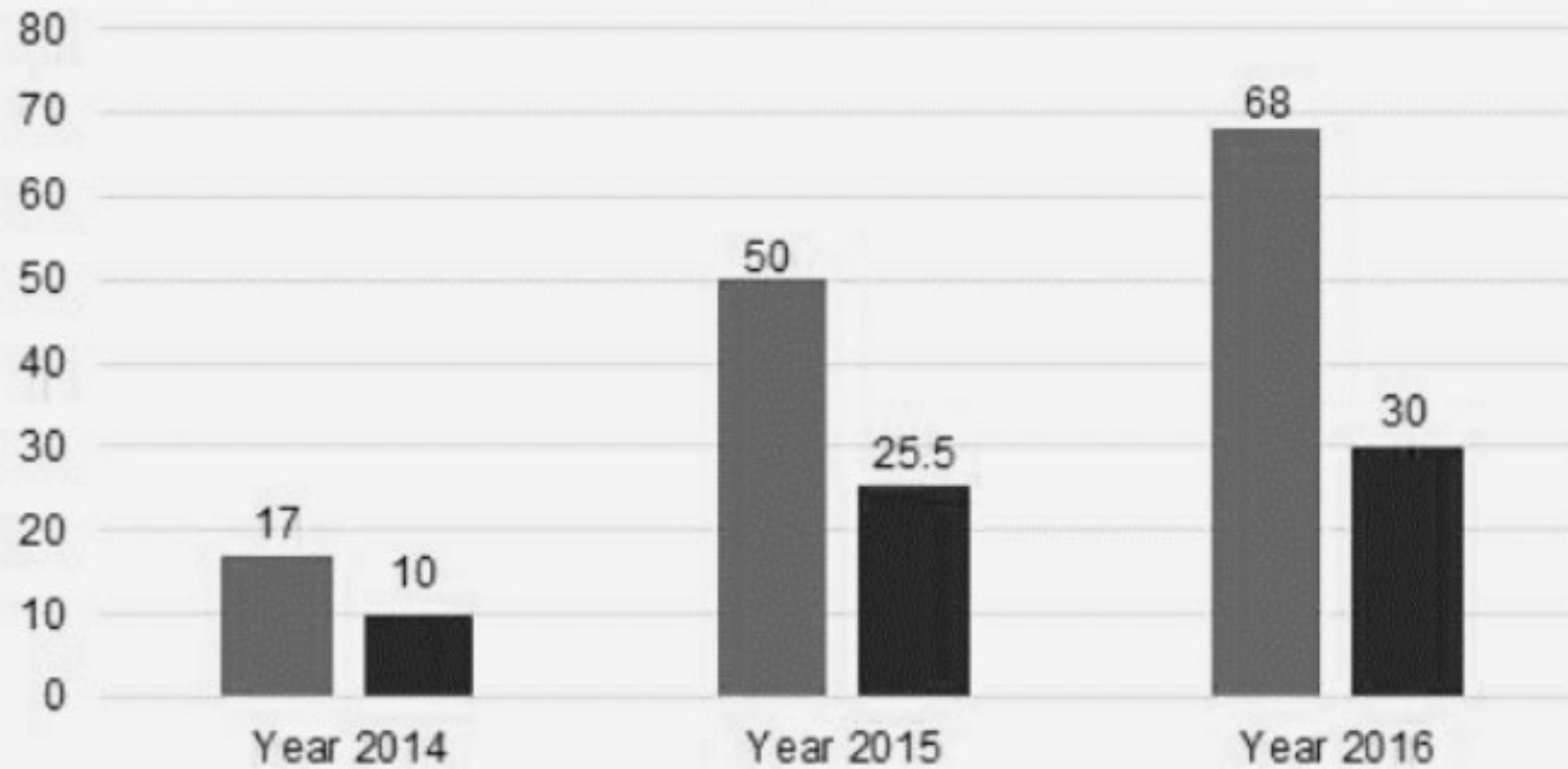
Projected growth rate of sharing economy and traditional rental, 2013 and 2025



Source: "The sharing economy—sizing the revenue opportunity," (Hawksworth et al., 2014)

The growth projections from the shared economy is significantly higher in sectors such as crowdfunding, online staffing, car sharing, and others. The growth projections are significantly lower in traditional sectors such as equipment, cars, and DVD rentals.

Increasing valuation of Uber and Airbnb (in \$ U.S. billions)



Source: "The sharing economy—sizing the revenue opportunity," (Hawksworth et al., 2014).

3. ML Application in AirBnB

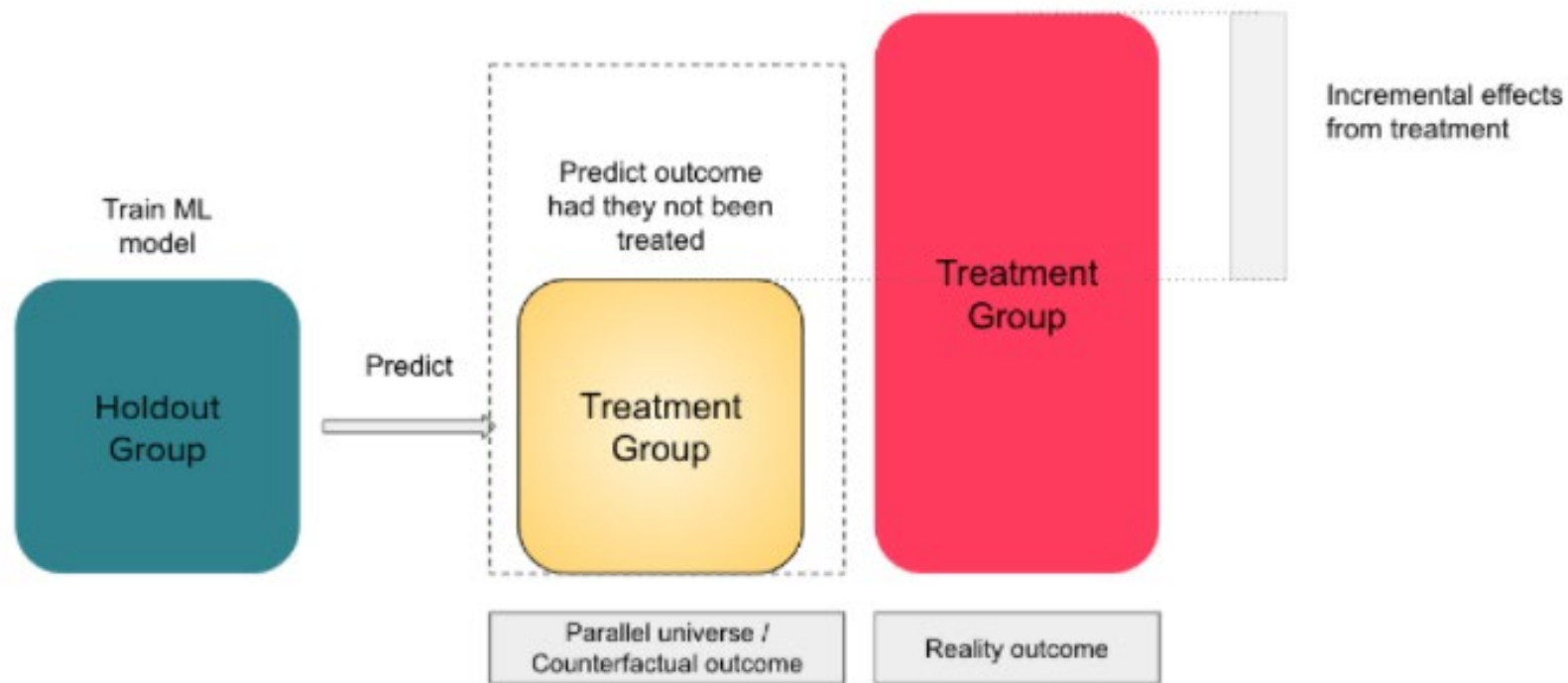
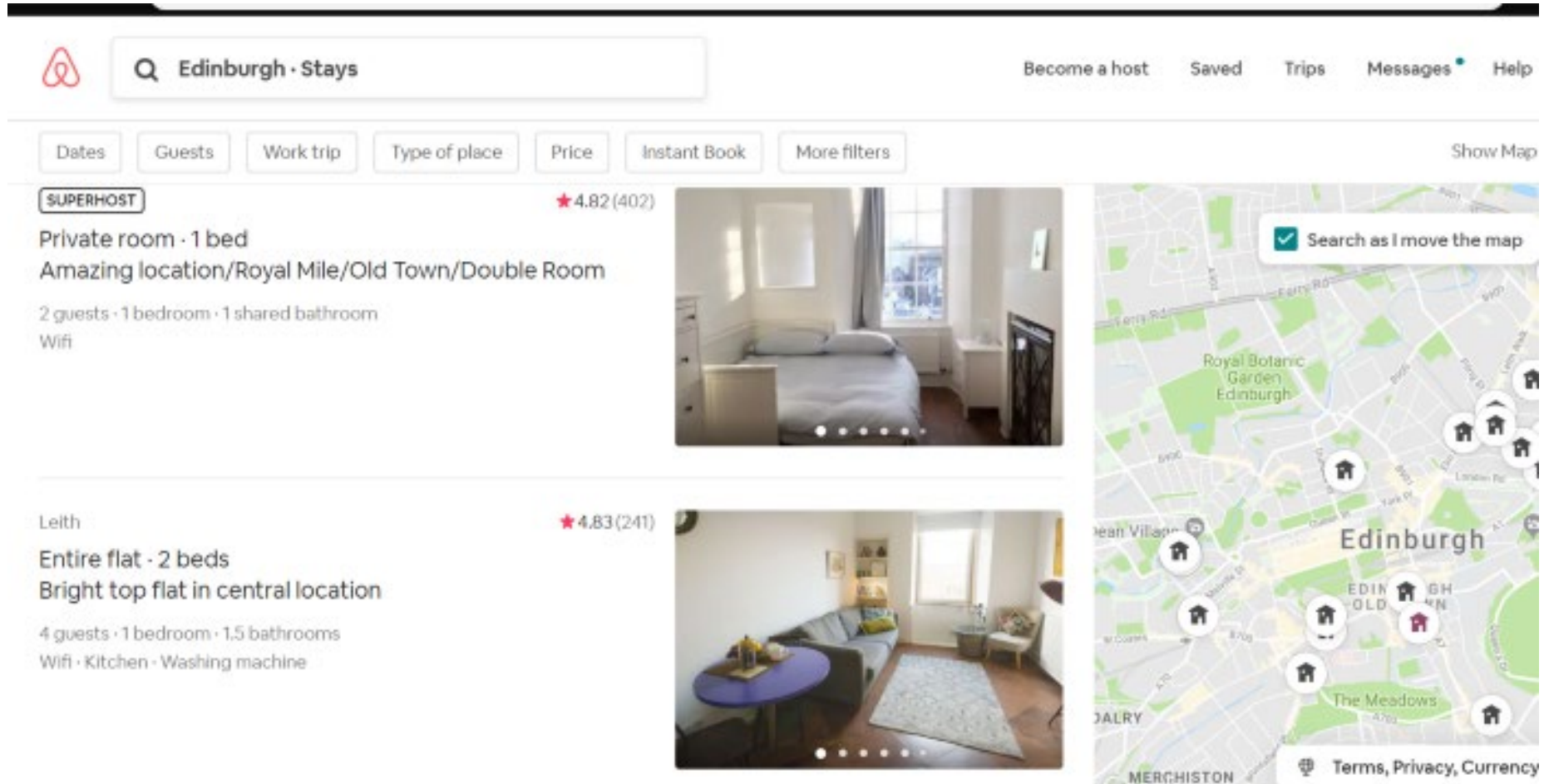


Figure 1: Estimation Process

ACE ML-Based Casual Inference at AirBnB (Gu & Wu, 2022)

3. ML Application in AirBnB



3. ML Application in AirBnB: Customer Support

Customer Support as a Task-Oriented Dialog Problem

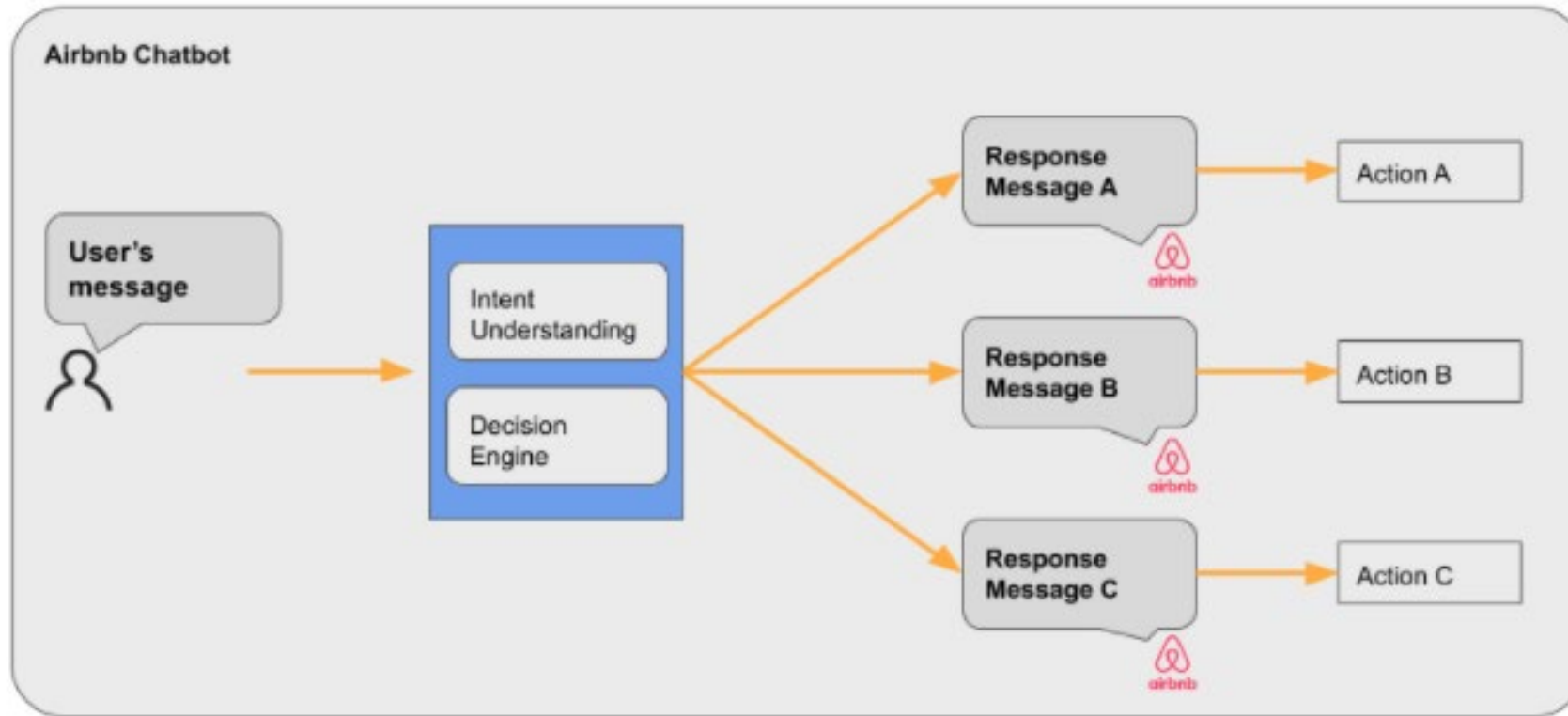
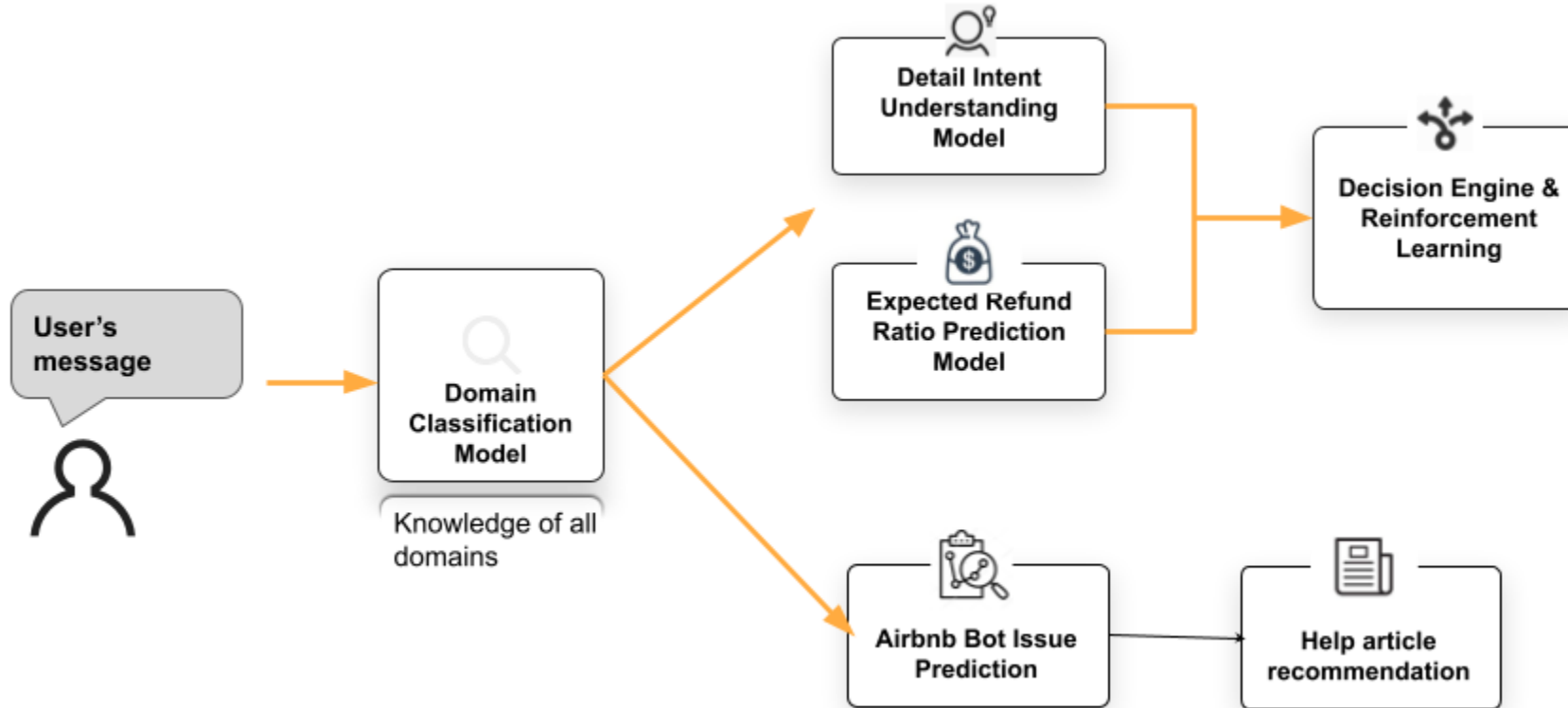


Figure 1. Airbnb's Chatbot as a task-oriented dialog system. It detects user intent and generates appropriate responses and completes the task through actions.

(Li & Zhao, 2021)

3. ML Application in AirBnB: Customer Support

Customer Support as a Task-Oriented Dialog Problem



(Li & Zhao, 2021)

3. ML Application in AirBnB: Customer Support

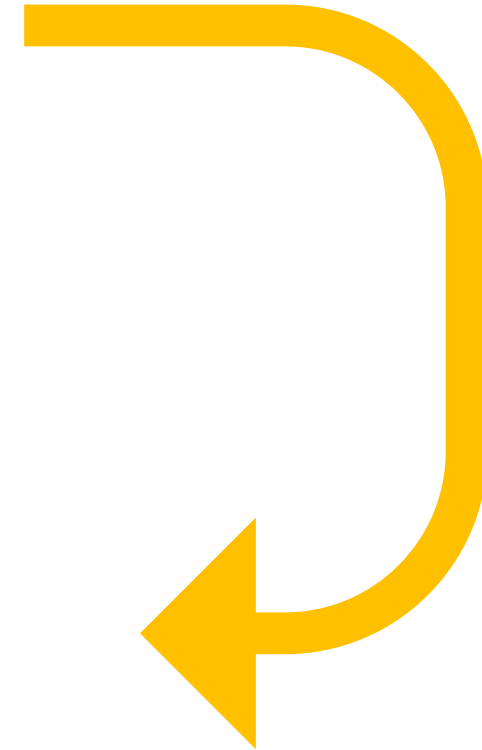
User's message to Airbnb:

Hello! I made a reservation wrongly. Thinking it was a whole apartment rental when it was actually just a room. I didn't pay attention. I immediately spoke to my host, she agreed to refund me and asked me to request the refund money from the app, but I can't find the option.

Question: Who initiated the cancellation?

Answer:

- 1. The host initiated the cancellation, or the host could not accommodate the guest*
- 2. The guest initiated the cancellation*
- 3. Not mentioned*



3. ML Application in AirBnB: Customer Support

Question: Do the host and guest agree on a refund?

Answer:

- 1. Host agrees on offering a refund and the refund amount*
- 2. Host and guest are having some differences on the refund amount*
- 3. Host disagrees with issuing a refund or already declined it*
- 4. Agreement not mentioned about refund*
- 5. Refund not mentioned at all*

Q&A problems with multiple-choice answers are normally modeled as a **multi-class classification** problem, where each class maps to one question.

(Li & Zhao, 2021)

3. ML Application in AirBnB: Customer Support

Question: Is the guest asking how they can get what they want? (how to get refund, what to do, etc)

Answer:

1. Yes
2. No

Question: Is the guest asking how they can get a refund, if is it possible, or how much refund can they get?

Answer:

1. Yes
2. No

(Li & Zhao, 2021)

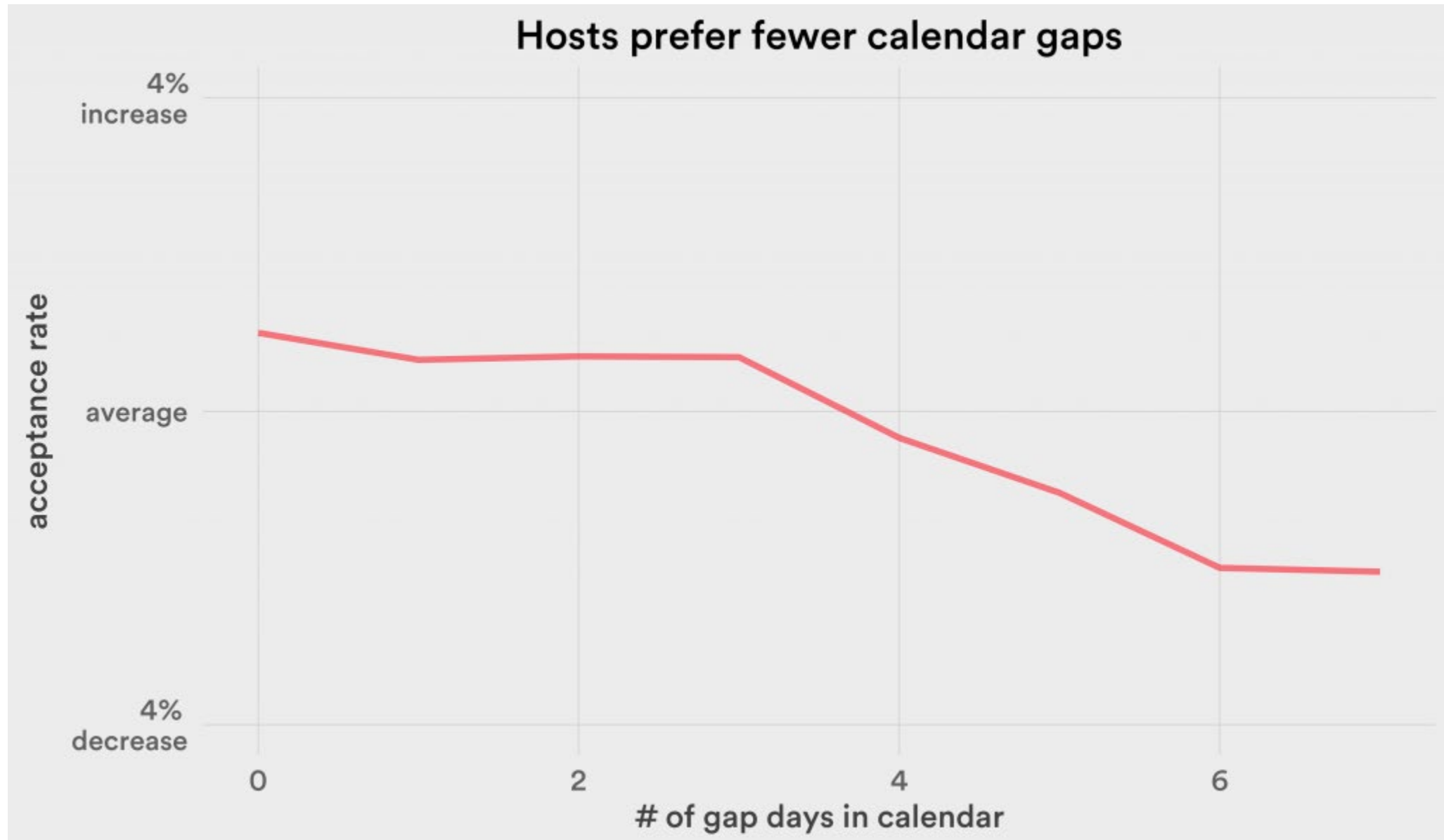
3. ML Application in AirBnB: Decision Making



What affects hosts' acceptance decisions?

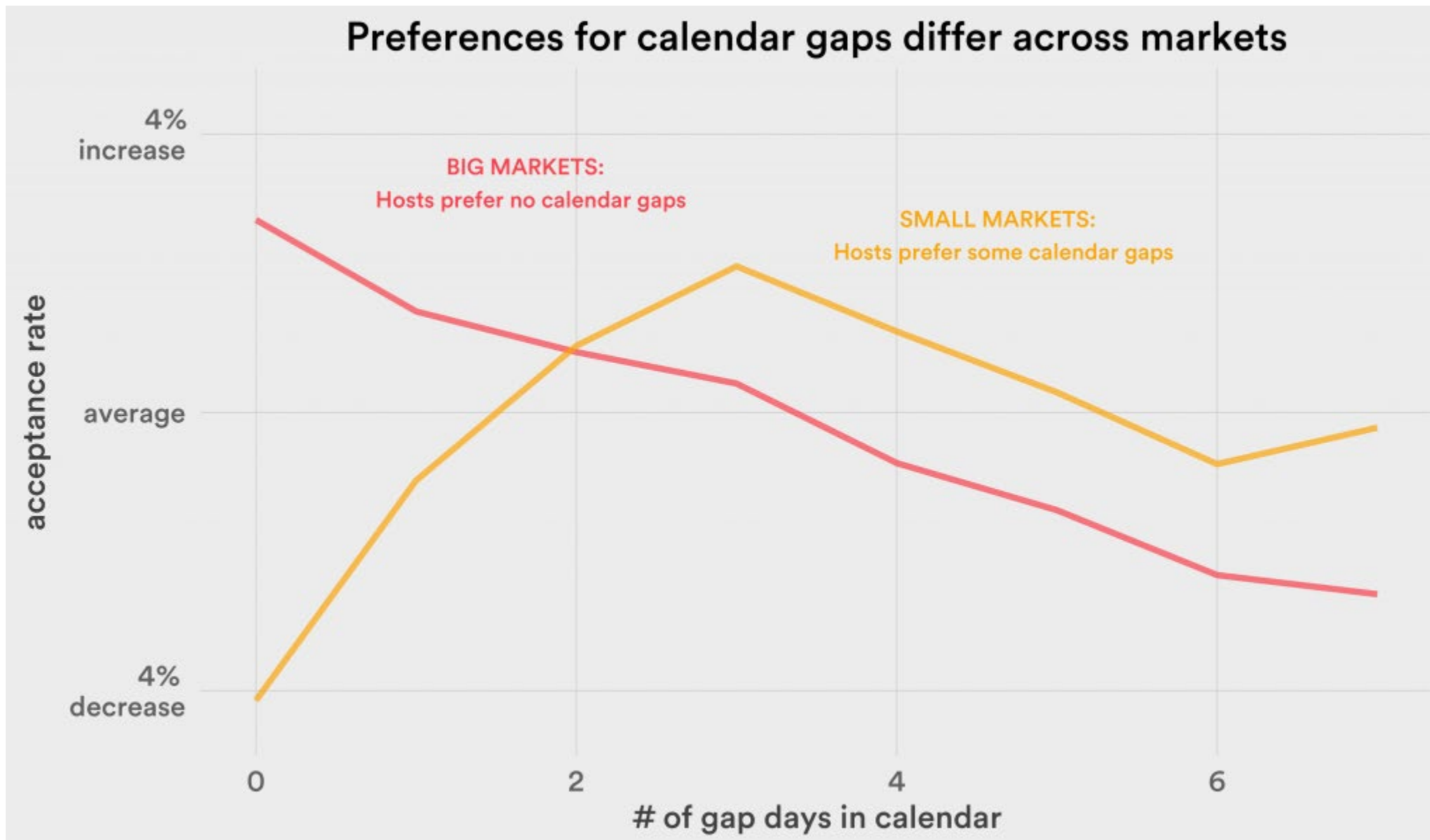
(Ifnach, 2015)

3. ML Application in AirBnB: Decision Making

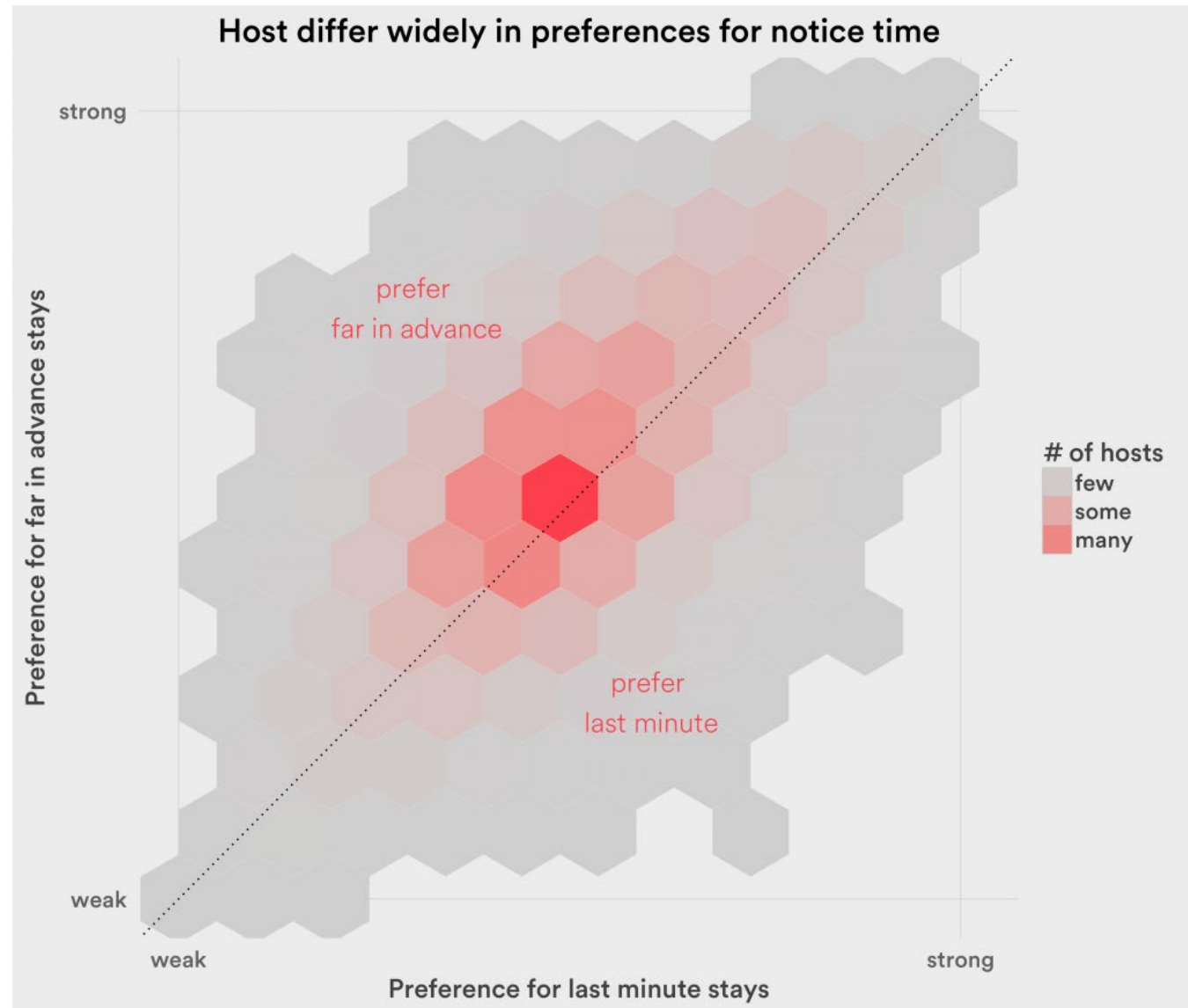


(Ifnach, 2015)

3. ML Application in AirBnB: Decision Making



3. ML Application in AirBnB: Decision Making



(Ifnach, 2015)

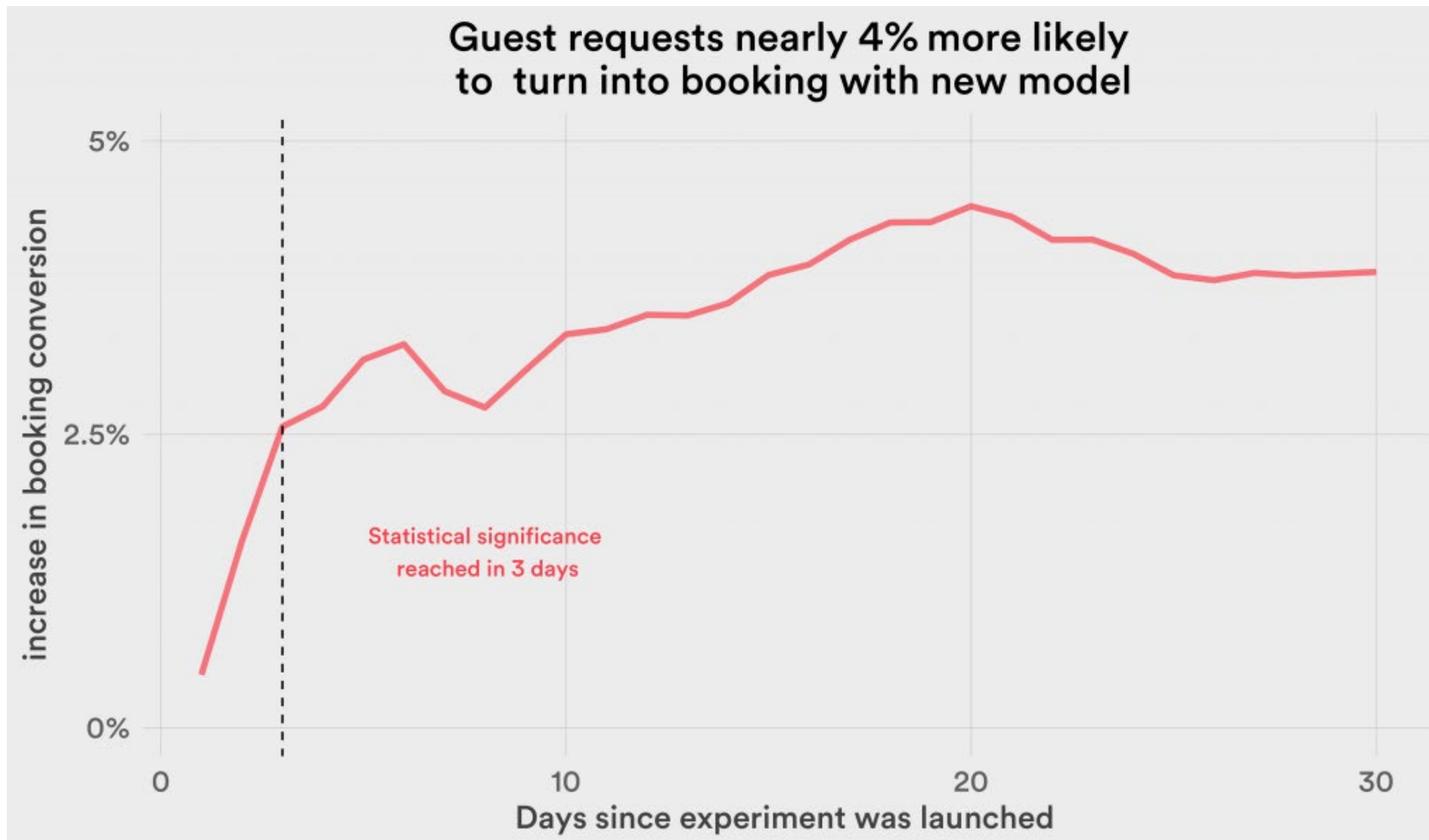
3. ML Application in AirBnB: Decision Making

All these findings pointed to the same conclusion: if we could promote in our search results hosts who would be more likely to accept an accommodation request resulting from that search query, we would expect to see happier guests and hosts and more matches that turned into fun vacations (or productive business trips).



(Ifrah, 2015)

3. ML Application in AirBnB: Decision Making



Airbnb publicizes its ML modules



[Mobile](#) [Open Source](#) [Events](#) [Blog](#) [Github](#) [Careers](#)

Open Source

Open source is at the heart of what we do at Airbnb

- [Code of Conduct](#)
- [Sponsored Projects](#)

[All projects](#) [Data](#) [Backend](#) [Frontend](#) [Mobile](#) [Infrastructure](#) [Style guides](#) [Testing](#)



Airflow Use Apache Airflow (incubating) to author workflows as directed acyclic graphs (DAGs) of tasks
★ 21,759



Aerosolve A machine learning package built for humans
★ 4,707



Airpal Web UI for PrestoDB
★ 2,759



BinaryAlert Serverless real-time and retroactive malware detection
★ 1,149



DeepLinkDispatch Easy declaration and routing of your deep links
★ 4,003



Hammerspace Hash-like interface to persistent, concurrent, off-heap storage
★ 331









AirMapView A view abstraction to provide a map user interface with various underlying map providers
★ 1,806



Enzyme JavaScript Testing utilities for React
★ 19,571

Other useful sources: <https://medium.com/airbnb-engineering>



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z zhiying gu · 3 days ago

Artificial Counterfactual Estimation (ACE): Machine Learning-Based Causal Inference at Airbnb

By: Zhiying Gu, Qianrong Wu Summary What if you wanted to measure the impact of a change to your business, but it was not possible to run a...


Causal Inference 10 min read



 Bryon Ross · Feb 24


Rebuilding Payment Orchestration at Airbnb

How we maintained reliable money movement while migrating Airbnb's payment orchestration system from the legacy monolithic application to a service-oriented architecture — By: Bryon Ross, Feifeng Yang, Sophie Be...



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<http://airbnb.io>

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End of Doc.

Thank
You

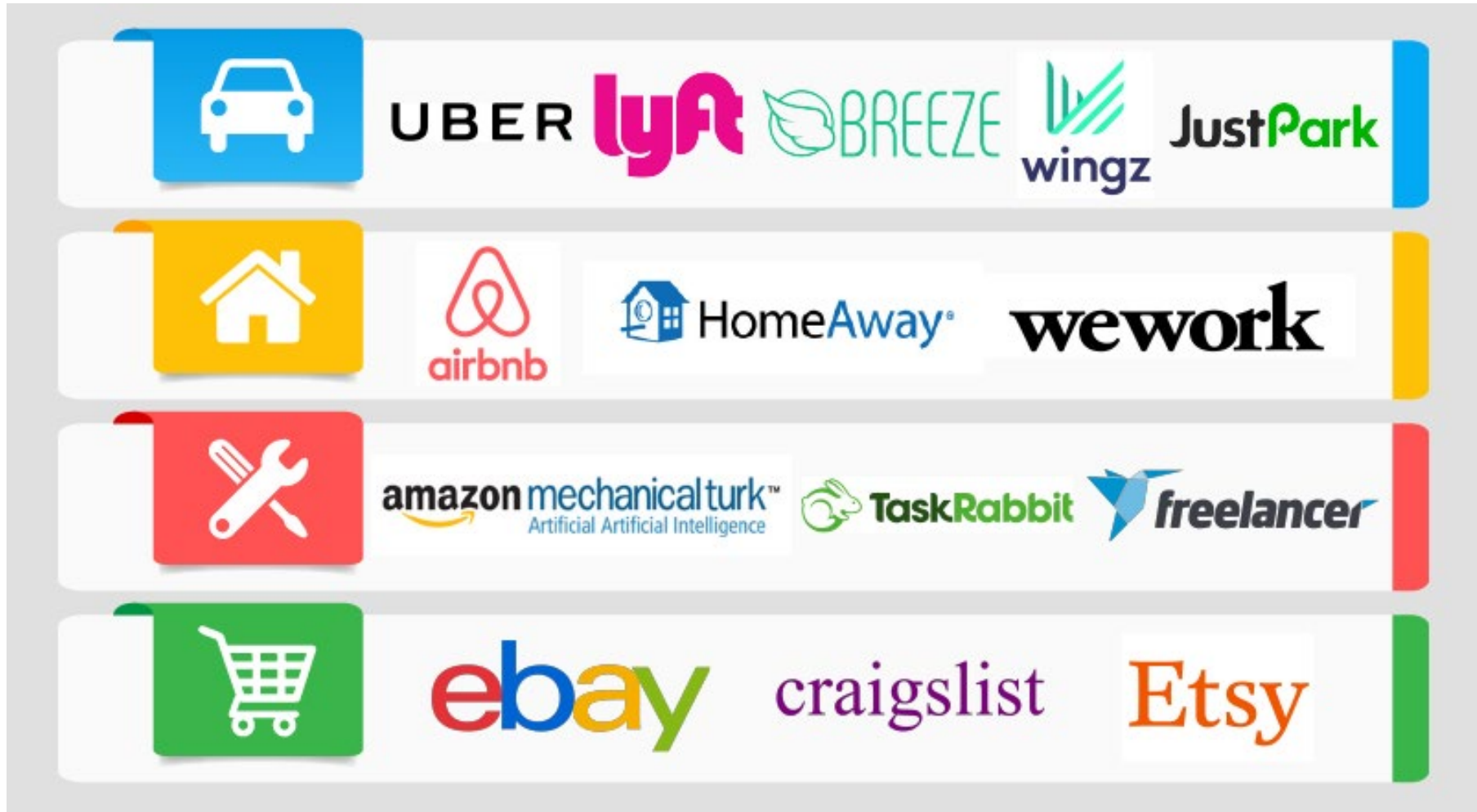
Machine Learning Application For Shared Economy Part 2

Urban Information Lab

Prof. Dr. Junfeng Jiao



1. Introduction: Shared Economy?

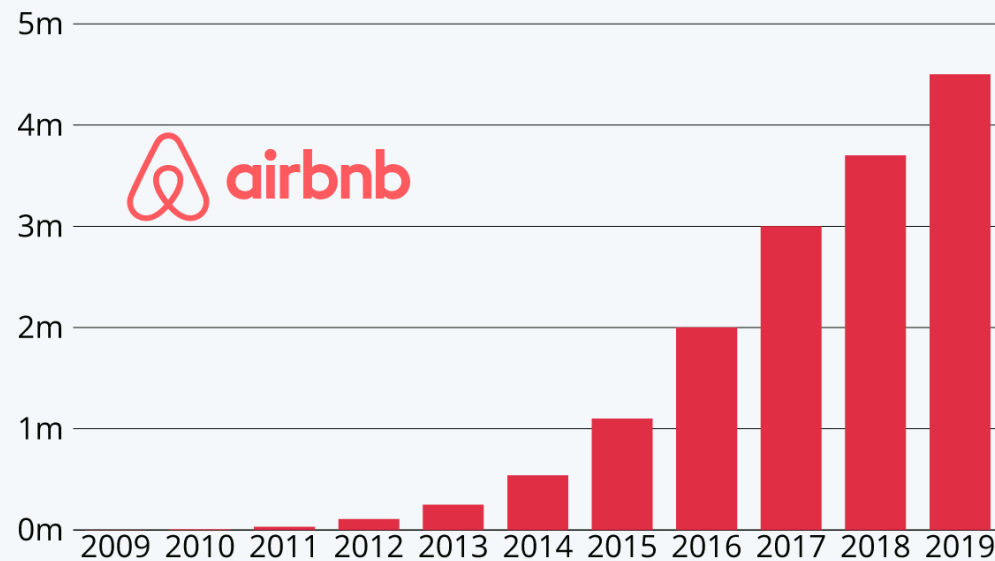


2. Airbnb



New Year's Peak Illustrates Airbnb's Growing Stature

Estimated number of guests staying at Airbnb listings worldwide on New Year's Eve

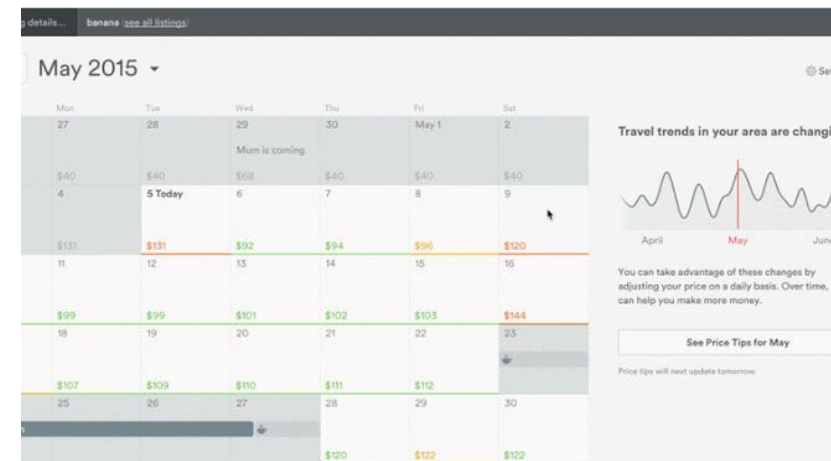
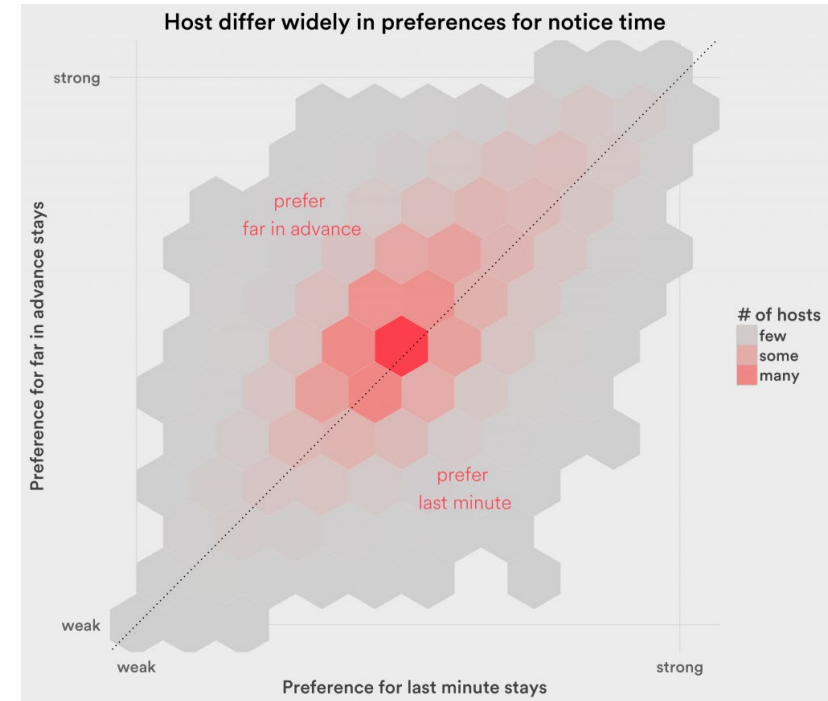
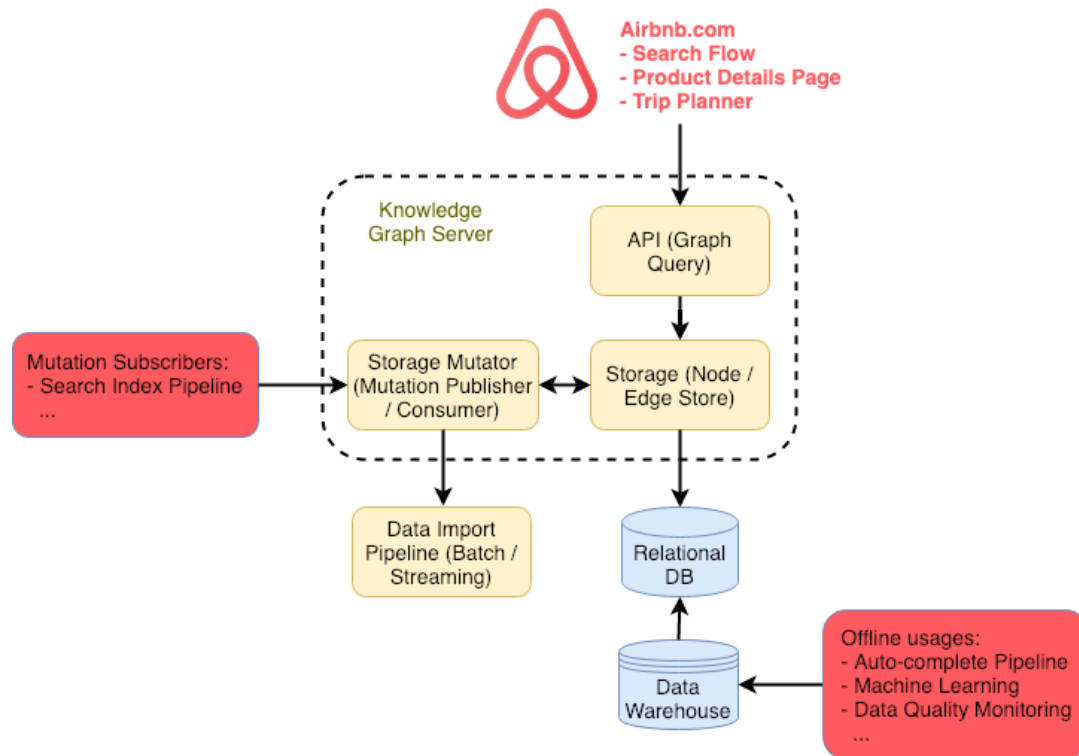


Sources: Airbnb, Jon Erlichman



statista

2. Airbnb: With ML

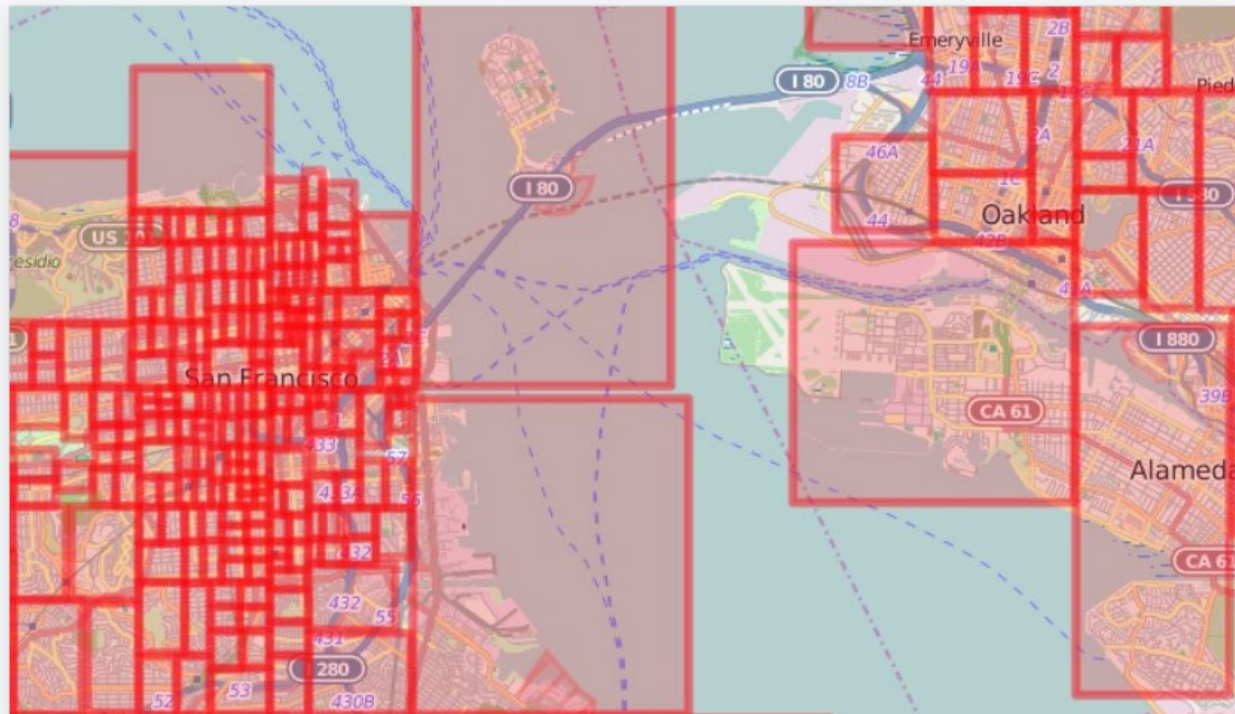


3. Aerosolve

Aerosolve

A machine learning package built for humans.

Get Started



Example: Neighborhood polygons based on listing density in San Francisco, generated using a multi-scale Kd-tree model.

<http://airbnb.io/aerosolve/>

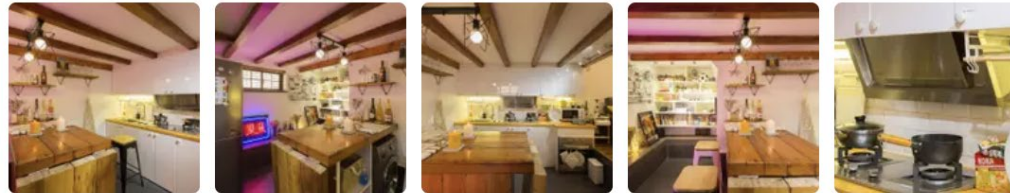
3. Aerosolve



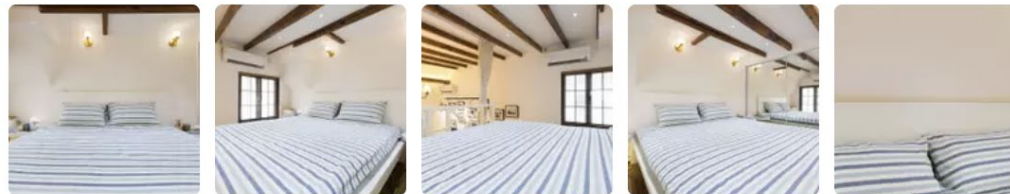
4. Categorizing Listing Photos at Airbnb



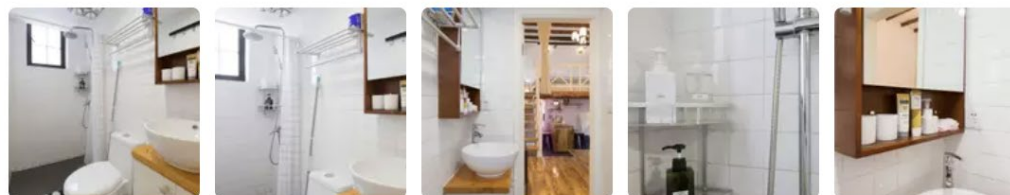
Living room



Full kitchen



Bedroom

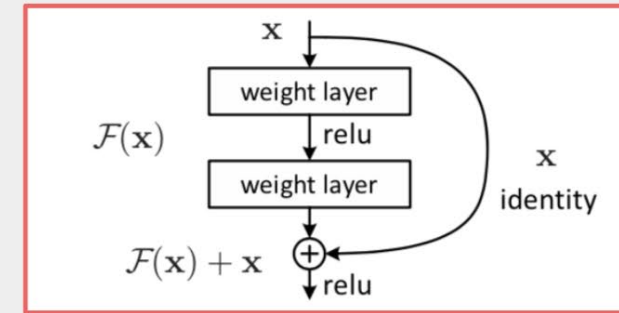


Full bathroom

(Yao, 2018)

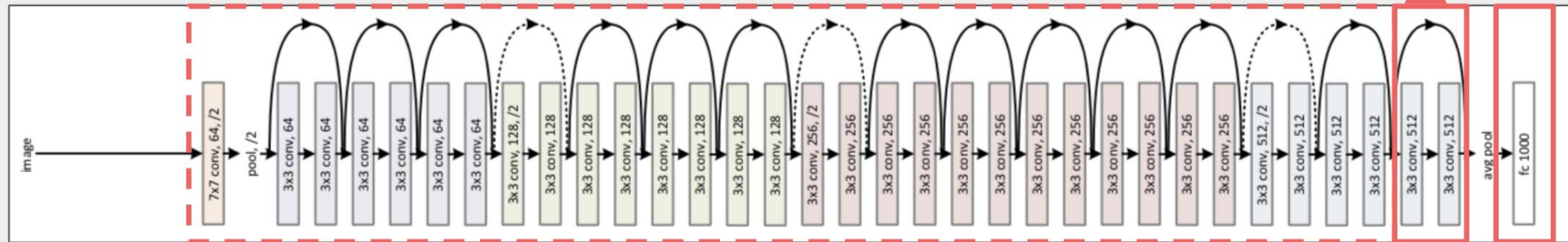
4. Categorizing Listing Photos at Airbnb

Retrain ResNet50

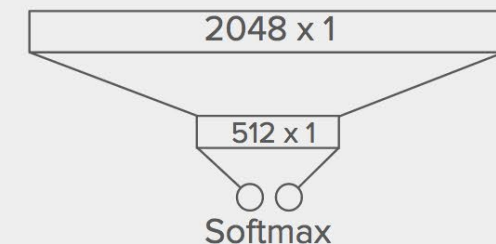


Residual Learning Block

ResNet50 Diagram



Re-architect fully-connected layers



4. Categorizing Listing Photos at Airbnb

Label :
Kitchen



Stairway up to Bedroom and **Kitchen**

Label :
Living Room



Hallway to the Bedroom from **living room**

Label :
Bathroom



Master room with **Bathroom** and king size bed

Label :
Bedroom



View from **Bedroom**

Label :
Swimming
Pool



Plenty of space to wander, garden next to the **swimming pool**

Label :
View



View of living space from Kitchen

4. Categorizing Listing Photos at Airbnb

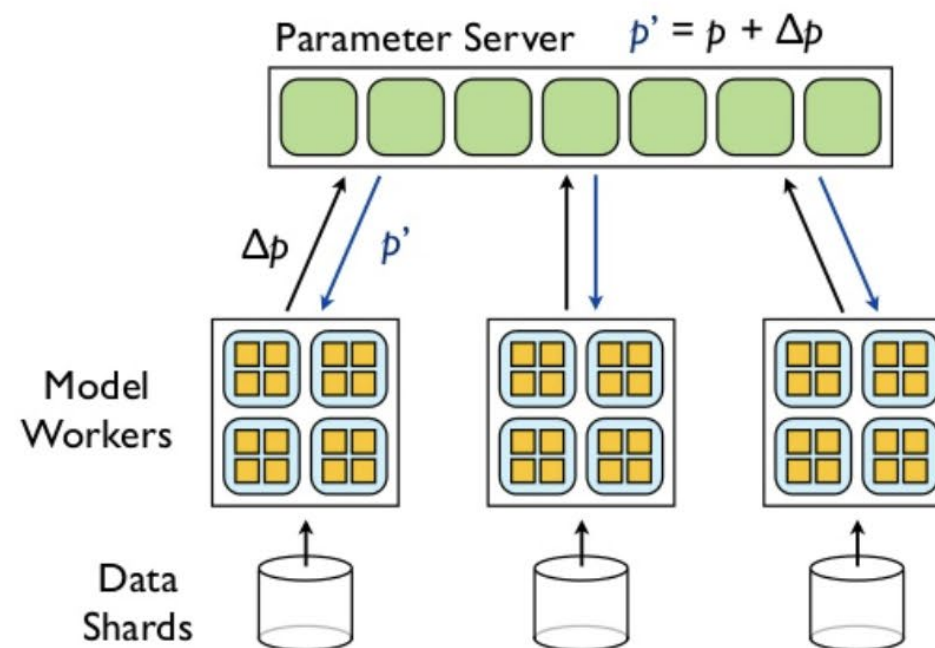
GPU Performance

Distributed SGD

NVIDIA-SMI 384.111				Driver Version: 384.111			
GPU Fan	Name Temp	Perf	Persistence-M Pwr:Usage/Cap	Bus-Id	Disp.A Memory-Usage	Volatile Uncorr. GPU-Util Compute M.	ECC
0	Tesla K80	P0	132W / 149W	00000000:00:17.0	Off 10946MiB / 11439MiB	95%	Default
1	Tesla K80	P0	156W / 149W	00000000:00:18.0	Off 10946MiB / 11439MiB	94%	Default
2	Tesla K80	P0	155W / 149W	00000000:00:19.0	Off 10946MiB / 11439MiB	91%	Default
3	Tesla K80	P0	160W / 149W	00000000:00:1A.0	Off 10944MiB / 11439MiB	85%	Default
4	Tesla K80	P0	135W / 149W	00000000:00:1B.0	Off 10944MiB / 11439MiB	96%	Default
5	Tesla K80	P0	162W / 149W	00000000:00:1C.0	Off 10944MiB / 11439MiB	97%	Default
6	Tesla K80	P0	137W / 149W	00000000:00:1D.0	Off 10942MiB / 11439MiB	98%	Default
7	Tesla K80	P0	149W / 149W	00000000:00:1E.0	Off 10942MiB / 11439MiB	96%	Default
Processes:				GPU Memory Usage			
GPU	PID	Type	Process name				

Data Parallelism:

Asynchronous Distributed Stochastic Gradient Descent



4. Categorizing Listing Photos at Airbnb

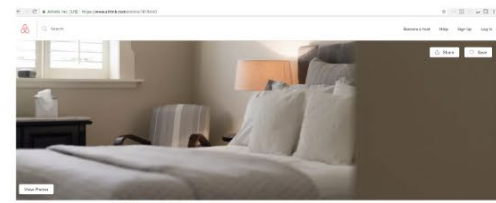
Bedroom Or Not?



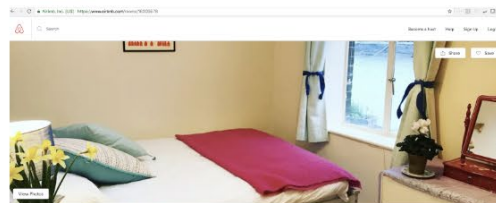
Pool Or Not?



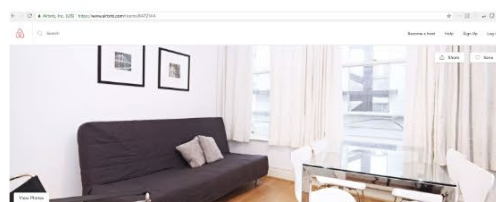
4. Categorizing Listing Photos at Airbnb



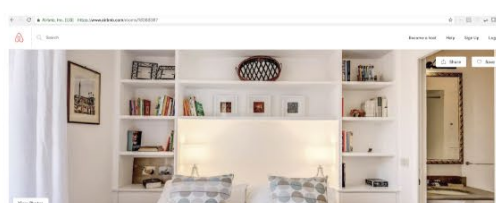
Lovely Executive B&B, between beaches and city



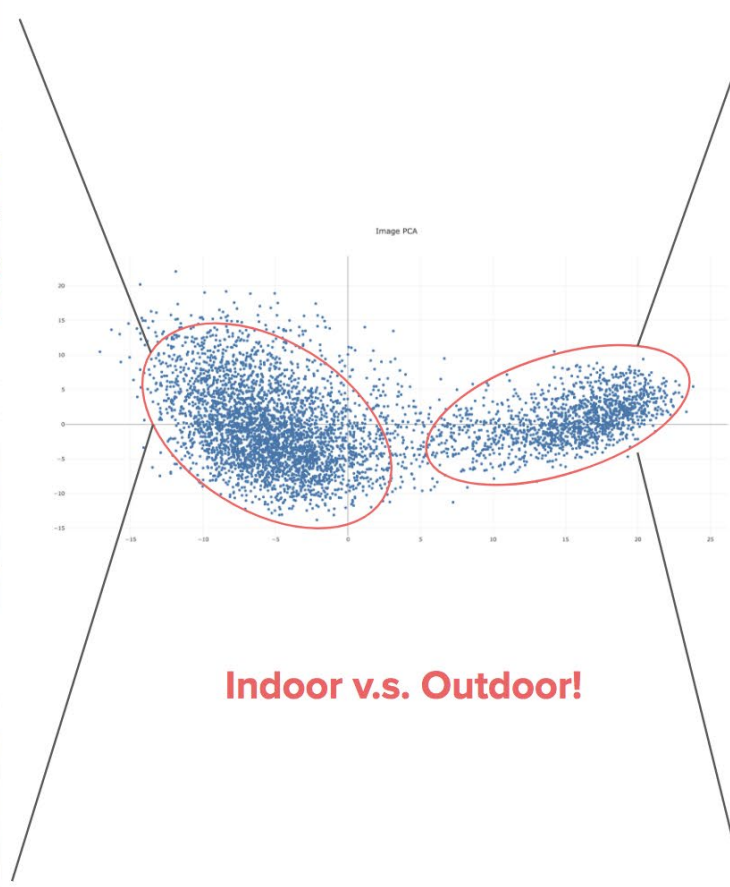
Your own charming Marylebone Mews House



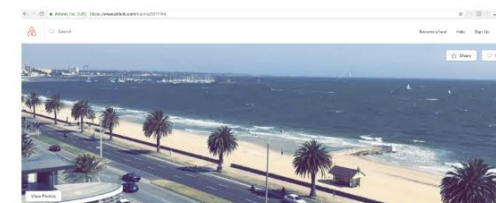
(CLO1) Great Flat in Central London



Vatican Views - Real 2 bdr 2AC| Wifi | Heat



Spinnaker on Albert Park



Grand Prix Locality



Nuwerus Lodge Paarl - Luxury Room 5



Cozy and Spacious OneBedroom Apt in West Hollywood

(Yao, 2018)

100

Dates: - |

Room Type:
 ☒ Entire home/apt
 ☐ Private room
 ☐ Shared room

Price Range: (\$10 - \$452)

Filters
③ Additional fees apply. Taxes may be added.

Only 10% of listings are left for these dates.

We recommend booking soon, or trying different dates.

\$231

Renovated elegant Victorian w/ yard
Entire home/apt · 4 guests · ★★★★★ · 148 reviews

\$104

NEW Private room near CCSF, easy parking, quiet...
Private room · 2 guests

5. Predicting Airbnb Rental Prices



DGOMONOV · UPDATED 3 YEARS AGO



2560

New Notebook



Download (3 MB)



New York City Airbnb Open Data

Airbnb listings and metrics in NYC, NY, USA (2019)



Data

Code (648)

Discussion (37)

Metadata

Link: <https://www.kaggle.com/dgomonov/new-york-city-airbnb-open-data?resource=download>

6. About Dataset

About Dataset

Context

Since 2008, guests and hosts have used Airbnb to expand on traveling possibilities and present more unique, personalized way of experiencing the world. This dataset describes the listing activity and metrics in NYC, NY for 2019.

Content

This data file includes all needed information to find out more about hosts, geographical availability, necessary metrics to make predictions and draw conclusions.

Acknowledgements

This public dataset is part of Airbnb, and the original source can be found on this [website](#).

Inspiration

- What can we learn about different hosts and areas?
- What can we learn from predictions? (ex: locations, prices, reviews, etc)
- Which hosts are the busiest and why?
- Is there any noticeable difference of traffic among different areas and what could be the reason for it?

Usability ⓘ

10.00

License

CC0: Public Domain

Expected update frequency

Annually

6. About Dataset

*Minor variation may exist

New York City Airbnb Open Data

Data Code (648) Discussion (37) Metadata

2560

New Notebook

Download (3 MB)


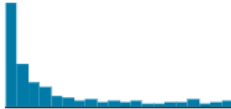


Detail Compact Column

10 of 16 columns

About this file

"ABNYC2019" - Summary information and metrics for listings in New York City. It is good for exploration, visualizations and predictions.

id	name	host_id	host_name	neighbourhood_g...	neighb
listing ID	name of the listing	host ID	name of the host	location	area
 2539 36.5m	47906 unique values	 2438 274m	11453 unique values	Manhattan 44% Brooklyn 41% Other (7130) 15%	Williamsb Bedford- Other (41
2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensingt
2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown
3647	THE VILLAGE OF HARLEM...NEW YORK !	4632	Elisabeth	Manhattan	Harlem
3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton
5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Ha
5099	Large Cozy 1 BR Apartment In Midtown East	7322	Chris	Manhattan	Murray t
5121	BlissArtsSpace!	7356	Garon	Brooklyn	Bedford-

AB_NYC_2019.csv

New_York_City_.png

Summary

2 files

16 columns

WORK HARD



End of Doc.

Thank
You