A Framework for Quantifying Airbnb Supply, Occupancy Rates and Travel Purpose

presented to
SCAG Modeling Task Force

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presented by
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Chao Wang
Background

TRB Paper 18-05542
» A Framework for Quantifying Airbnb Supply, Occupancy Rates and Travel Purpose to Support Visitor Modeling

Authors
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Motivations

Issues with the existing hotel data

» Usually obtained from establishment-based databases

» Often suffer from missing information about number of rooms and room occupancy

New trends

» Home-rental services such as Airbnb have continued to grow

» They have been largely ignored in visitor models
Objectives

- Identify new data sources
- Develop a framework of using Airbnb data for visitor modeling
- Quantify the impact of Airbnb on the transportation system
Hotel Data

New data sources

» Employing web-scraping tools on various hotel aggregation sites

» Utilizing data from an application program interface (API) generated by a host of travel websites

» and so on...
Hotel Data

Information Contained in the New Data Sources

» Number of rooms
» Hotel geographical information
» Star-based rating
» Pricing
» Availability of rooms
» Any other publicly available information
Airbnb Data Overview

Insideairbnb.com

» Independent, non-commercial web-site
» Compiled public information from the Airbnb web-site
» Locations are anonymized (up to 450 feet from the actual address)
» Provided a snapshot of listings
» Three types of data
  ▪ Listings
  ▪ Availability calendar for 365 days in the future
  ▪ User reviews for each listing
Information in the Airbnb Data

Airbnb Database
Linked by Listing ID

Listings Data
- Listing ID
- Description
- Neighborhood
- Host ID
- Latitude/Longitude
- Property Type
- Accommodates
- Bedrooms
- Amenities
- Price
- Minimum Nights
- House Rules
- Cancellation Policy
- Number of Reviews
- Review Scores

Calendar Data
- Listing ID
- Availability for one year
- Price on each day
  (if it is available)

Review Data
- Listing ID
- Review ID
- Stay Date
- Reviewer ID
- Reviews
Data used for the Analysis

Hotel Data
- A detailed database of hotel rooms in *Los Angeles County* as of March 2017

Airbnb Data
- Four months’ worth of data for *Los Angeles County* (August 2016, March 2017, April 2017 and May 2017)
Comparison of Hotel vs. Airbnb
# Comparison of Hotel vs. Airbnb

<table>
<thead>
<tr>
<th></th>
<th>Hotel</th>
<th>Airbnb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Hotels</td>
<td>Entire Home/Apt</td>
</tr>
<tr>
<td>Number of properties</td>
<td>740</td>
<td>17,995</td>
</tr>
<tr>
<td>Number of bedrooms</td>
<td>80,460</td>
<td>28,664</td>
</tr>
<tr>
<td>Accommodates</td>
<td>241,380</td>
<td>79,493</td>
</tr>
<tr>
<td>Accommodates per room</td>
<td>3</td>
<td>2.77</td>
</tr>
<tr>
<td>Average rate</td>
<td>$223</td>
<td>$252</td>
</tr>
<tr>
<td>Minimum duration of stay</td>
<td>1 day</td>
<td>3.75 days</td>
</tr>
</tbody>
</table>
## Top Five Airbnb Neighborhoods

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Number of Airbnb Rooms</th>
<th>Number of Hotel Rooms</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venice</td>
<td>2,939</td>
<td>449</td>
<td>2,490</td>
</tr>
<tr>
<td>Hollywood</td>
<td>2,220</td>
<td>2,304</td>
<td>-84</td>
</tr>
<tr>
<td>Long Beach</td>
<td>1,360</td>
<td>5,494</td>
<td>-4,134</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>1,190</td>
<td>2,469</td>
<td>-1,279</td>
</tr>
<tr>
<td>Downtown</td>
<td>982</td>
<td>6,902</td>
<td>-5,920</td>
</tr>
</tbody>
</table>
Study Framework

- Listings Data: Quantifying Airbnb Supplies
- Calendar Data: Measuring Occupancy Rates
- Review Data: Capturing Travel Purposes
Quantifying Airbnb Supplies

- Listings data contain Airbnb supply information such as property type, number of rooms, etc.
- Property latitude and longitude can be used to summarize Airbnb supply at any given geographic level, such as at a TAZ level
Study Framework

Calendar Data

Measuring Occupancy Rates

Measuring Occupancy Rates

- Calendar data provide property availability for 365 days in the future—however, they do not differentiate between a booked night versus an unavailable night (listing is off the market)

- An approach is proposed to measure occupancy
Study Framework

Review Data

Capturing Travel Purposes

Capturing Travel Purposes

• **Review data** are the reviews of the Airbnb listings by Airbnb customers

• **Text mining** technique is used to analyze customer reviews to segment business and non-business visitors
Quantifying Airbnb Supplies

Number of bedrooms

Number of people Airbnb can accommodate

<table>
<thead>
<tr>
<th>Labels</th>
<th>Entire Home/Apt.</th>
<th>Private Room</th>
<th>Shared Room</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Home/Apt.</td>
<td>234</td>
<td>35</td>
<td>0</td>
<td>282</td>
</tr>
<tr>
<td>Private Room</td>
<td>129</td>
<td>20</td>
<td>3</td>
<td>162</td>
</tr>
<tr>
<td>Shared Room</td>
<td>257</td>
<td>51</td>
<td>20</td>
<td>328</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>31</td>
<td>3</td>
<td>94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labels</th>
<th>Entire Home/Apt.</th>
<th>Private Room</th>
<th>Shared Room</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Home/Apt.</td>
<td>939</td>
<td>83</td>
<td>0</td>
<td>1022</td>
</tr>
<tr>
<td>Private Room</td>
<td>729</td>
<td>70</td>
<td>2</td>
<td>851</td>
</tr>
<tr>
<td>Shared Room</td>
<td>928</td>
<td>70</td>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>Total</td>
<td>1256</td>
<td>116</td>
<td>3</td>
<td>1492</td>
</tr>
</tbody>
</table>
Measuring Occupancy Rates

Calculated as

\[
\frac{\text{the number of days that a listing is booked}}{\text{the number of days that this listing is on the market}}
\]

- Hosts with **multiple listings** leave their listings on the market at all times.
- Hosts with a **single listing** take their properties off the market periodically—old calendar data are used to determine whether a listing is booked or simply off the market.
Measuring Occupancy Rates

LA County Monthly Occupancy Rate May 2017

- Entire home/apt
- Private room
- Shared room
- All Listings

- Multiple Listing
- Single Listing
Capturing Travel Purposes (Text Mining)

- Business travel (20%)
  - business trip
  - work trip
  - went for work
  - went for business
  - close to work

- Leisure travel (80%)
  - pleasure trip
  - vacation
  - with family
  - with children/grandchildren
  - grandparents
  - with friends
  - with my partner/my boyfriend/my girlfriend
  - with my wife/my husband

![Word cloud chart showing travel purposes]

- Business: 18.8%
- Non-business: 81.2%
Impacts of Airbnb Visitors

- Airbnb Supplies
- Occupancy Rates
- Trip Purposes
  - For Business Trip
  - For Non-business Trip
- Trip Rate by Trip Purposes
  - Number of Business Trips
  - Number of Non-business Trips

- Housing Capacity
- People Living in Airbnb
Trip Rate by Trip Purposes

San Diego Visitor Survey

» business visitor: 3.17 trips per person

» non-business visitor: 2.73 trips per person
### Trips Generated in the Top 5 Airbnb Neighborhoods in LA

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Single-Listing Properties</th>
<th></th>
<th>Multi-Listing Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accommodates</td>
<td>Occupancy Rate</td>
<td>Accommodates</td>
<td>Occupancy Rate</td>
</tr>
<tr>
<td>Venice</td>
<td>3,264</td>
<td>63%</td>
<td>4,663</td>
<td>63%</td>
</tr>
<tr>
<td>Hollywood</td>
<td>2,377</td>
<td>50%</td>
<td>4,247</td>
<td>61%</td>
</tr>
<tr>
<td>Long Beach</td>
<td>1,921</td>
<td>54%</td>
<td>1,551</td>
<td>59%</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>1,680</td>
<td>57%</td>
<td>1,288</td>
<td>62%</td>
</tr>
<tr>
<td>Downtown</td>
<td>1,664</td>
<td>64%</td>
<td>1,940</td>
<td>68%</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>10,906</strong></td>
<td></td>
<td><strong>13,689</strong></td>
<td></td>
</tr>
</tbody>
</table>
# Trips Generated in the Top 5 Airbnb Neighborhoods in LA

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Business Visitors</th>
<th>Non-Business Visitors</th>
<th>Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venice</td>
<td>937</td>
<td>4,046</td>
<td>14,026</td>
</tr>
<tr>
<td>Hollywood</td>
<td>710</td>
<td>3,066</td>
<td>10,630</td>
</tr>
<tr>
<td>Long Beach</td>
<td>367</td>
<td>1,585</td>
<td>5,494</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>331</td>
<td>1,430</td>
<td>4,956</td>
</tr>
<tr>
<td>Downtown</td>
<td>449</td>
<td>1,938</td>
<td>6,718</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>2,794</strong></td>
<td><strong>12,065</strong></td>
<td><strong>41,824</strong></td>
</tr>
</tbody>
</table>
Summary

- There are 47,000 Airbnb users in the LA County.
- They make 132,000 trips per day.
- Airbnb visitors make 24 percent of total visitor trips in the LA County.
- This growing market of travelers should not be ignored.

![Pie chart showing Airbnb and Hotel Visitors]

- Airbnb Visitors: 132,000 (24%)
- Hotel Visitors: 426,000 (76%)
Questions?

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