Forecasting AsiaYo’s 1 month ahead Daily Room Occupancy in Different Cities for Supply Preparation

Team 1
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Business Problem

Especially on Holidays !!
Business Goal: Prepare for **supply deficiency** to prevent revenue losts
Client: COO, Operation Team
Opportunities: Supply preparation, Goal reference
Challenges: Not important or useful on ordinary days

Forecasting Goal: Forecast one month ahead Daily Room Occupancy in different cities

<table>
<thead>
<tr>
<th>Room Occupancy</th>
<th>11/1</th>
<th>11/2</th>
<th>11/3</th>
<th>12/1</th>
<th>12/2</th>
<th>12/3</th>
</tr>
</thead>
<tbody>
<tr>
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<td>30 days</td>
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<td>30 days</td>
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</tbody>
</table>

Time

Graph showing the forecasted daily room occupancy over a 30-day span in November and December.
Data Description

**AsiaYo**

**Booking Orders Data**
2016/1/1 ~ 2017/12/31 (730 days)

Sum across all orders based on check-in & check-out dates

**Room Occupancy Data**
2016/1/1 ~ 2018/8/31 (973 days)

Recalculate as 15/30/60 days before

**Taiwan Public Holidays Data**

**N days before ordered Data**

**Split by Country and City**

Top 5 cities in Taiwan
Top 4 cities in Japan

9 Time series

**Forecasts**

- Taiwan: 2016/5/20 ~ 2017/12/31
- Japan: 2017/1/01 ~ 2017/12/31
Data Exploration

- **Taipei region order before n days distribution**
- **Tokyo region order before n days distribution**

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- **Taipei region**
- **Tokyo region**
Methods

✔ Linear Regression
Predictors: Trend + External Data
External Data:
- Holidays (Taiwan / Japan)
- Sakura Season
- Sum of ordered rooms N days before (15, 30, 60 days)

✖ Smoothing
✖ Neural Net
✖ ARIMA

Benchmark: SNaive (Last Year)  SNaive (Last Month)
Prefer Over-Forecast than Under-Forecast

Evaluation:
✔ RMSE
✔ Time Plot
✔ Error Plot

Training Period:
Taiwan - 2016/5/20 ~ 2017/11/1 (~12/1)
Japan   - 2017/1/01 ~ 2017/11/1 (~12/1)

Validation Period:
Roll-Forward
2017/12/1~2017/12/31
## Evaluations

### RMSE among different cities (valid)

<table>
<thead>
<tr>
<th></th>
<th>Taipei</th>
<th>Yilian</th>
<th>Tainan</th>
<th>Taichung</th>
<th>Kaohsiung</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RMSE 15</strong></td>
<td>27.98</td>
<td>12.21</td>
<td>9.66</td>
<td>25.04</td>
<td>7.14</td>
</tr>
<tr>
<td><strong>RMSE 30</strong></td>
<td>55.97</td>
<td>25.87</td>
<td>29.95</td>
<td>83.13</td>
<td>10.50</td>
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<tr>
<td><strong>RMSE 60</strong></td>
<td>88.15</td>
<td>22.19</td>
<td>44.12</td>
<td>45.37</td>
<td>13.77</td>
</tr>
</tbody>
</table>

### RMSE of Holiday & Not-Holiday days (valid)

#### Taipei

<table>
<thead>
<tr>
<th></th>
<th>Holiday</th>
<th>Not-Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RMSE 15</strong></td>
<td>18.43</td>
<td>12.96</td>
</tr>
<tr>
<td><strong>RMSE 30</strong></td>
<td>41.78</td>
<td>22.01</td>
</tr>
<tr>
<td><strong>RMSE 60</strong></td>
<td>86.84</td>
<td>29.14</td>
</tr>
</tbody>
</table>

#### Tokyo

<table>
<thead>
<tr>
<th></th>
<th>Holiday</th>
<th>Not-Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RMSE 15</strong></td>
<td>2.55</td>
<td>2.16</td>
</tr>
<tr>
<td><strong>RMSE 30</strong></td>
<td>5.69</td>
<td>4.19</td>
</tr>
<tr>
<td><strong>RMSE 60</strong></td>
<td>9.34</td>
<td>7.40</td>
</tr>
</tbody>
</table>
Evaluations

Time Plots of forecasted values (Validation Period, Roll-forward)
Evaluations
Results & Recommendations

- Under-Forecast on ordinary days
- Over-Forecast on Holidays
- Performance on holidays should be improved. (Real important period)
- Japan has better performance than Taiwan, due to different booking behaviors.
  - Try different models for different countries
  - Try Ensemble
- Manual adjustment on some non-official holidays