Machine Learning

Price Prediction for Guest Urban Hotel Rates

By Demian Figueriedo

THE PROBLEM

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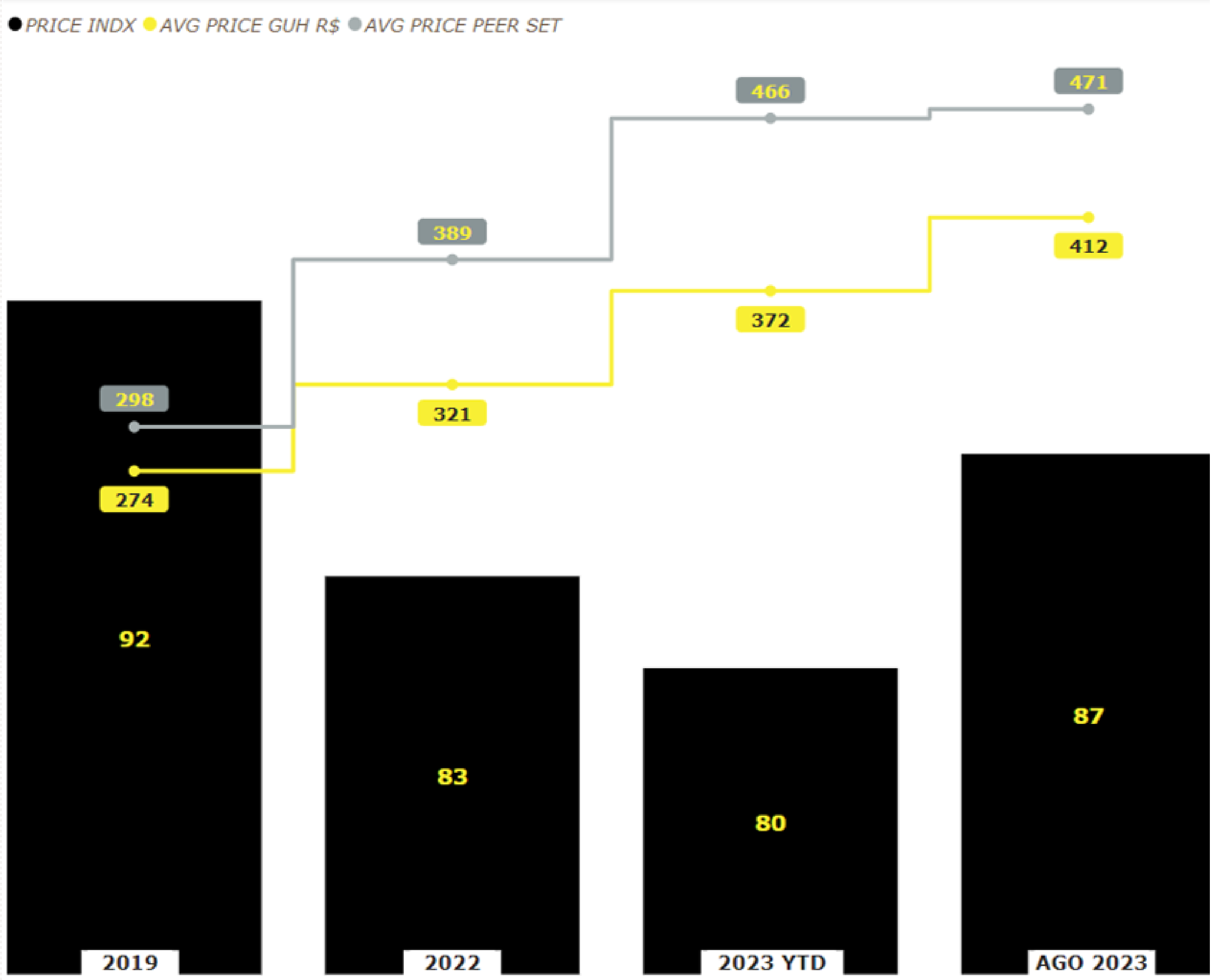
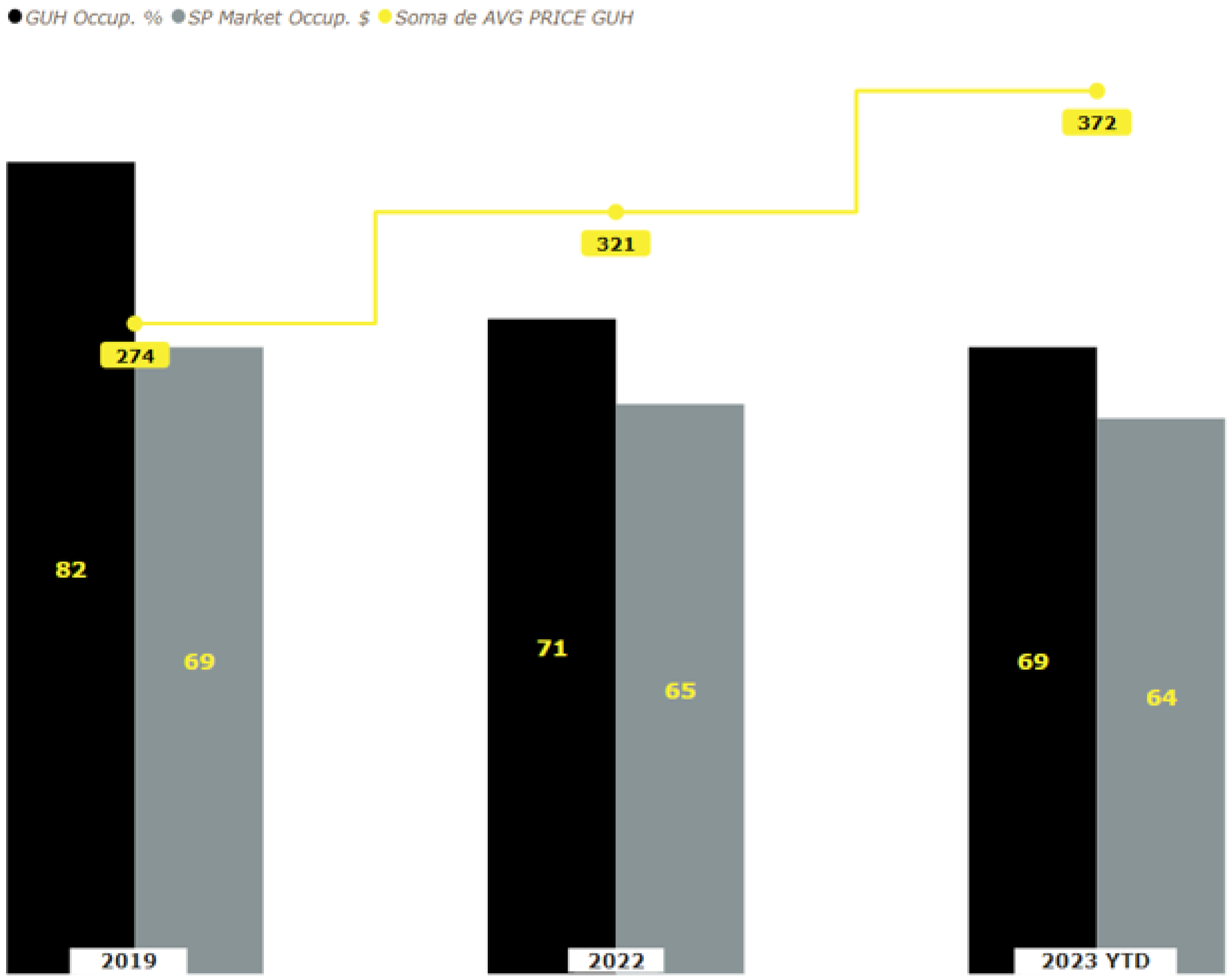
GUEST URBAN
SÃO PAULO

After pandemic market price o São Paulo hotel rates and occupancy rates has changed drastic.
It´s been difficult to apply with efficiency a well planned price policy.





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ML PROBLEM SOLVING ROUTES

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Demand forecasting

Competitive analysis

Personalized pricing

Price optimization

Dynamic pricing

best price points by considering factors like occupancy rates, customer preferences, historical data, and revenue goals

ML PROCESS

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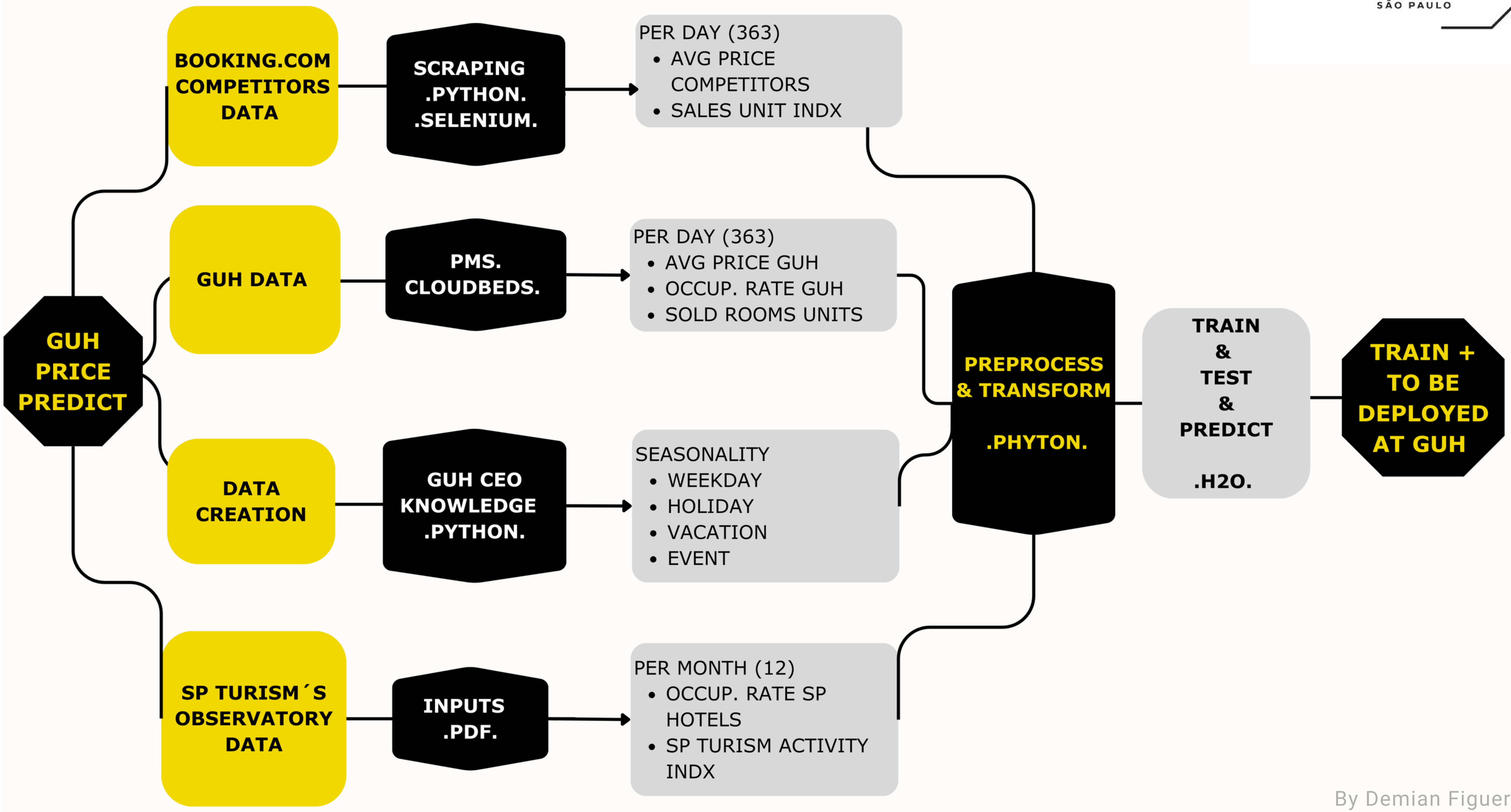

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ML TRAIN PREP

DATA TRAIN - Sept 2022 - Aug 2023

```
4
5 train.head(50)
```

Shape 363 x 12

Out[118]:

	sales_rate_comparison	avg_rate_compt	weekday_sazonality_guh	occup_competitors	imat_sp	event_sazonality_guh	occup_rate_guh	holidays_saz
0	-0.5039	410.93	5.0	0.6922	0.959	0.0	1.0000	
1	0.0000	390.67	1.0	0.6922	0.959	0.0	0.6923	
2	-0.3103	398.69	2.0	0.6922	0.959	0.0	0.5385	
3	-0.8272	432.25	3.0	0.6922	0.959	0.0	0.4615	
4	-0.5062	442.07	3.0	0.6922	0.959	0.0	0.6923	
5	-0.6033	441.27	4.0	0.6922	0.959	1.0	0.8462	
6	-0.6089	406.09	5.0	0.6922	0.959	0.0	0.9231	
7	-0.6471	408.77	5.0	0.6922	0.959	0.0	0.6923	
8	-0.8049	422.12	1.0	0.6922	0.959	0.0	0.4615	
9	-0.8316	386.19	2.0	0.6922	0.959	0.0	0.5385	
10	-0.6000	429.16	3.0	0.6922	0.959	0.0	1.0000	
11	-0.5556	464.14	3.0	0.6922	0.959	0.0	1.0000	
12	-0.6418	481.69	4.0	0.6922	0.959	0.0	1.0000	
13	-0.6364	473.43	5.0	0.6922	0.959	0.0	0.8462	
14	-0.8033	424.48	5.0	0.6922	0.959	0.0	1.0000	
15	-0.7555	422.09	1.0	0.6922	0.959	0.0	0.8462	
16	-0.6226	369.23	2.0	0.6922	0.959	0.0	0.6154	
17	-0.7333	402.63	3.0	0.6922	0.959	0.0	1.0000	
18	-0.4563	442.92	3.0	0.6922	0.959	0.0	1.0000	
19	-0.7064	461.12	4.0	0.6922	0.959	0.0	1.0000	

CORRELATION MATRIX

	sales_rate_comparison	avg_rate_compt	weekday_sazonality_guh	occup_competitors	imat_sp	event_sazonality_guh	sold_rooms_guh	occup_rate_guh	holidays_sazonality_guh	vacation_sazonality	year	month	day	avg_rate_guh
sales_rate_comparison														
avg_rate_compt	0.36													
weekday_sazonality_guh	0.028	0.03												
occup_competitors	-0.13	-0.07	0.0098											
imat_sp	-0.061	0.061	0.027	0.51										
event_sazonality_guh	-0.17	-0.15	0.066	0.32	0.4									
sold_rooms_guh	-0.033	-0.0046	0.47	0.28	0.15	0.2								
occup_rate_guh	-0.033	-0.0046	0.47	0.28	0.15	0.2	1							
holidays_sazonality_guh	-0.096	0.014	0.07	0.13	0.072	0.22	0.17	0.17						
vacation_sazonality	-0.013	0.036	0.011	0.73	0.26	0.2	0.28	0.28	0.093					
year	-0.087	0.35	-0.001	-0.094	0.4	0.049	-0.055	-0.055	0.14	-0.23				
month	0.054	-0.24	0.022	0.14	-0.17	-0.063	-0.0076	-0.0076	-0.092	0.3	-0.82			
day	-0.02	-0.092	-0.011	0.0067	0.0026	-0.021	-0.0084	-0.0084	-0.003	-0.023	-0.0097	0.022		
avg_rate_guh	0.021	0.15	0.087	-0.11	0.11	0.017	0.018	0.018	0.16	-0.02	0.3	-0.03	0.038	

0.75 0.50 0.25 0.00 −0.25 −0.50 −0.75

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TRAIN & TESTS RESULTS

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H2O

Leader Model
Distributed Random Forest

TRAIN

RMSE R$ 27,15

MAE R$ 18,95

Metrics AVG R$ 23,05

TEST

RMSE R$ 26,94

MAE R$ 18,54

Metrics AVG R$ 22,74

Variable Importances:

variable	relative_importance	scaled_importance	percentage
imat_sp	1459657.7500000	1.0	0.1811754
occup_competitors	1104379.7500000	0.7566018	0.1370777
day	1019247.6250000	0.6982785	0.1265109
avg_rate_compt	894215.8125000	0.6126202	0.1109917
occup_rate_guh	861226.8125000	0.5900197	0.1068971
sales_rate_comparison	740664.9375000	0.5074237	0.0919327
month	666133.8750000	0.4563631	0.0826818
weekday_sazonality_guh	504431.1875000	0.3455818	0.0626109
holidays_sazonality_guh	342944.9062500	0.2349488	0.0425670
year	218149.8906250	0.1494528	0.0270772
event_sazonality_guh	141117.5156250	0.0966785	0.0175158
vacation_sazonality	104428.4531250	0.0715431	0.0129619

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PREDICT

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Do to the GUH's drasctic prices increases in Jul, Aug and Sept 2023, TRAIN model needs to b more up to date prices.

	predict	avg_rate_guh	Date
0	362.867928	436.69	2023-09-01
1	367.221548	439.37	2023-09-02
2	334.686727	427.36	2023-09-03
3	337.098624	374.63	2023-09-04
4	348.288622	376.97	2023-09-05
5	363.034139	400.62	2023-09-06
6	372.053621	431.20	2023-09-07
7	370.622413	435.40	2023-09-08

In [145]:

```python
mean_GUH = prediction['avg_rate_guh'].mean()
mean_PREDICT = prediction['predict'].mean()

print("Mean GUH rate Sept 2023:", mean_GUH)
print("Mean predict Sept 2023: {:.2f}".format(mean_PREDICT))
```

```
Mean GUH rate Sept 2023: 415.28
Mean predict Sept 2023: 356.98
```

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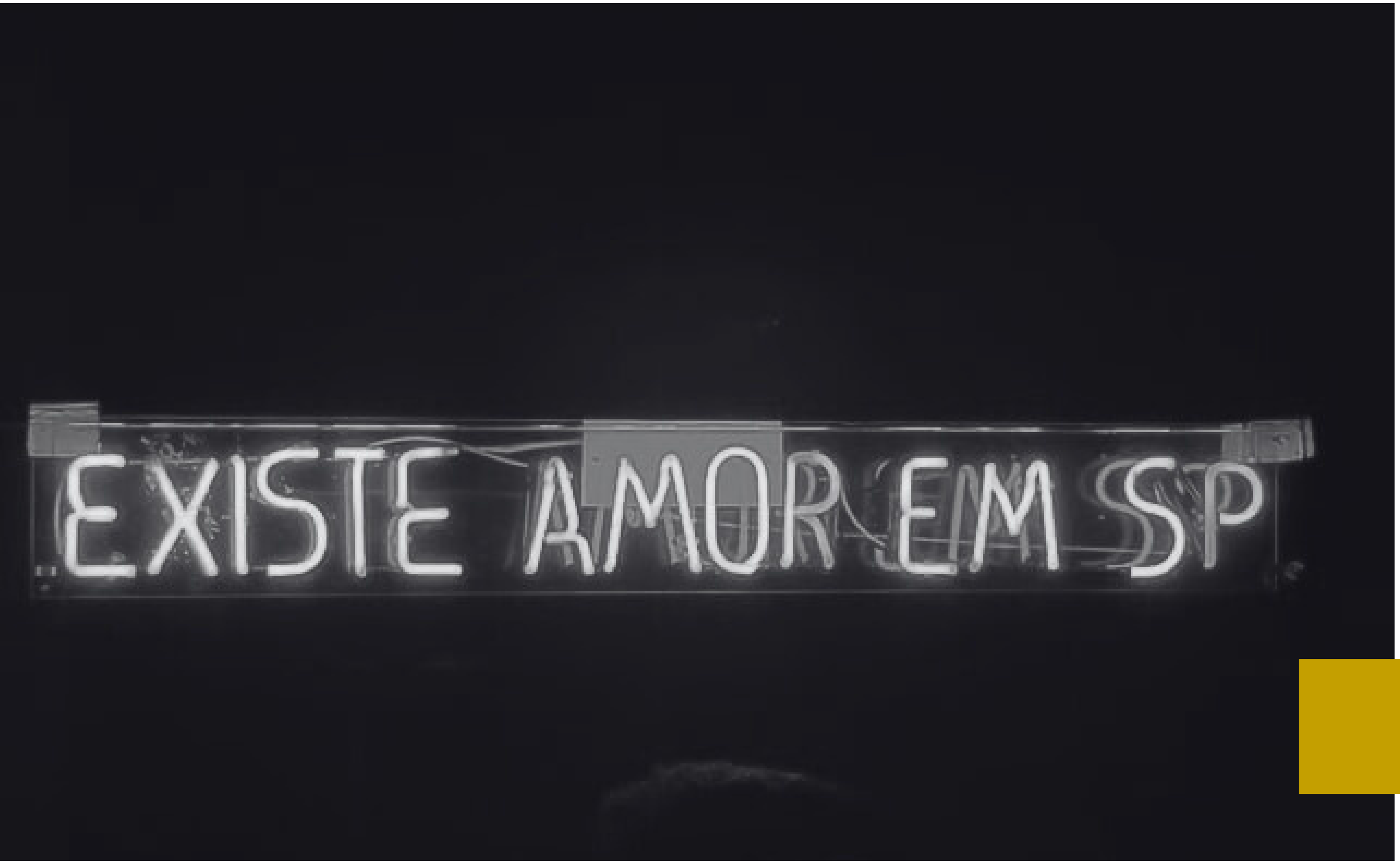

NEXT STEPS

01 Update TRAIN, with new price increase

02 Deploy model to GUH

03 Use other ML's routes for GUH problem

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Thank
You

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