Exploring Tools for Interpretable Machine Learning

Dr. Juan Orduz

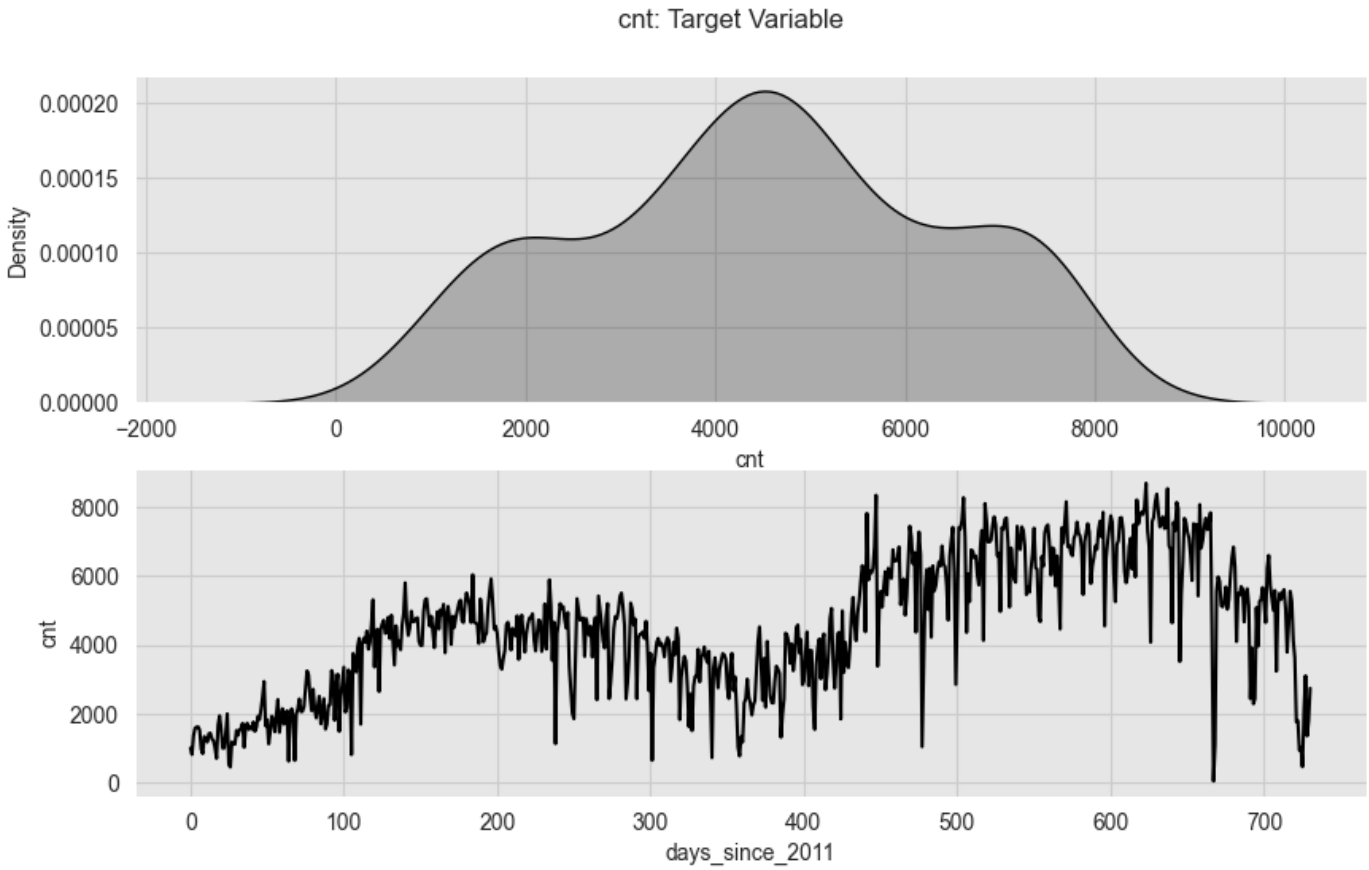
PyData Global 2021

Outline

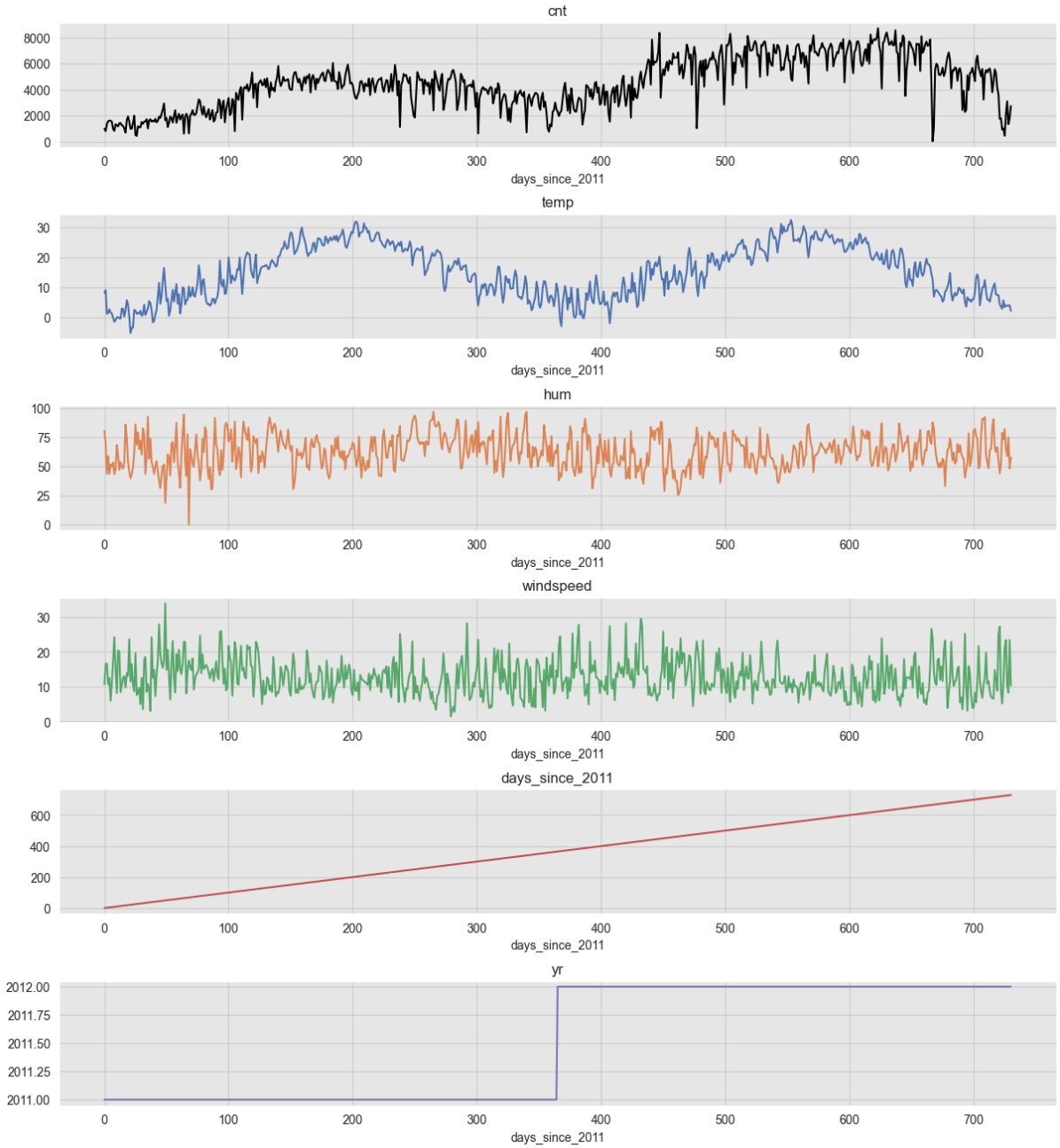
[1]

Target Variable - cnt: Daily Bike Rents

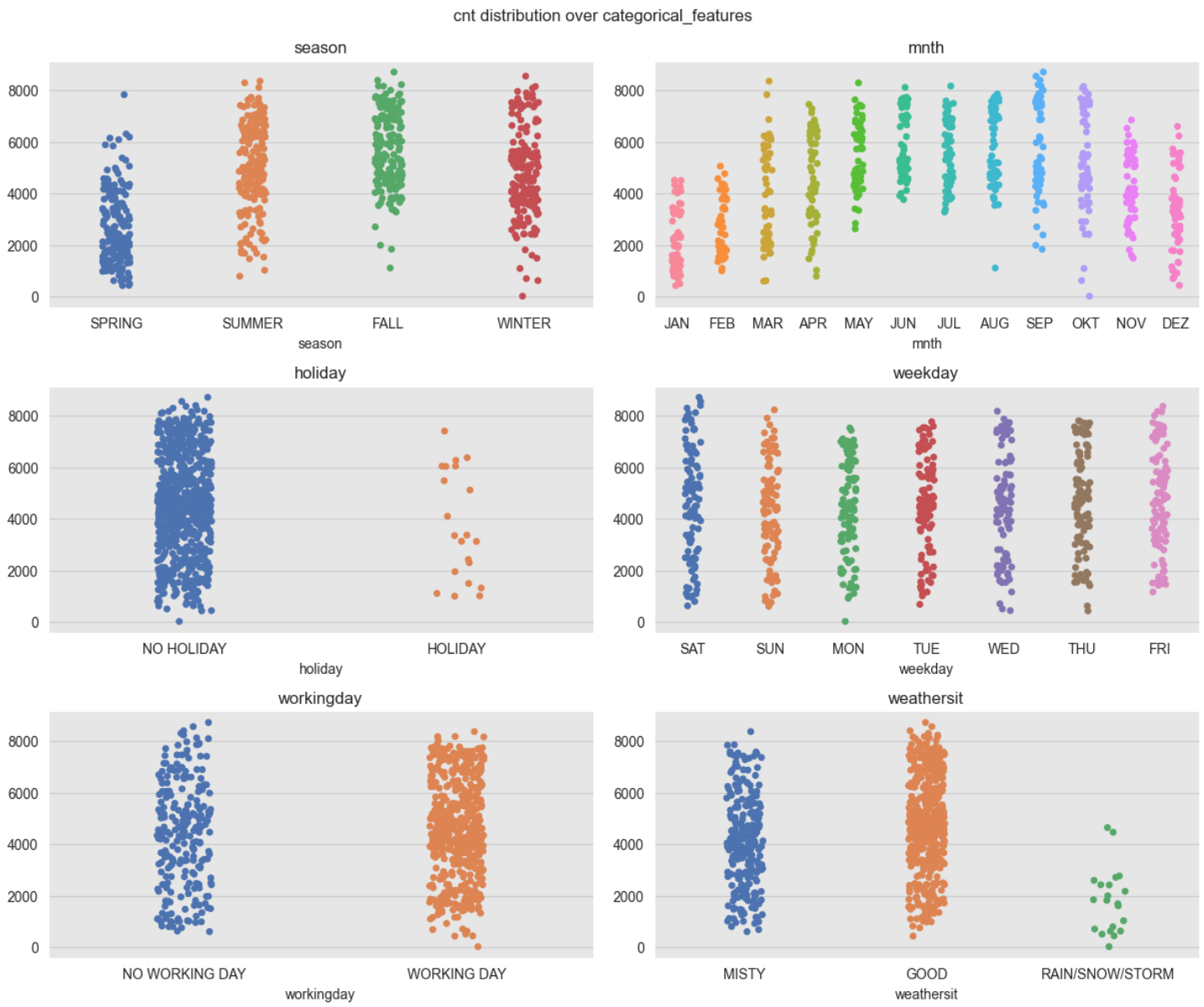
	season	yr	mnth	holiday	weekday	workingday	weathersit	temp	hum	windspeed	cnt	days_since_2011
0	SPRING	2011	JAN	NO HOLIDAY	SAT	NO WORKING DAY	MISTY	8.175849	80.5833	10.749882	985	0
1	SPRING	2011	JAN	NO HOLIDAY	SUN	NO WORKING DAY	MISTY	9.083466	69.6087	16.652113	801	1
2	SPRING	2011	JAN	NO HOLIDAY	MON	WORKING DAY	GOOD	1.229108	43.7273	16.636703	1349	2
3	SPRING	2011	JAN	NO HOLIDAY	TUE	WORKING DAY	GOOD	1.400000	59.0435	10.739832	1562	3
4	SPRING	2011	JAN	NO HOLIDAY	WED	WORKING DAY	GOOD	2.666979	43.6957	12.522300	1600	4



Continuous Regressors



Categorical Regressors



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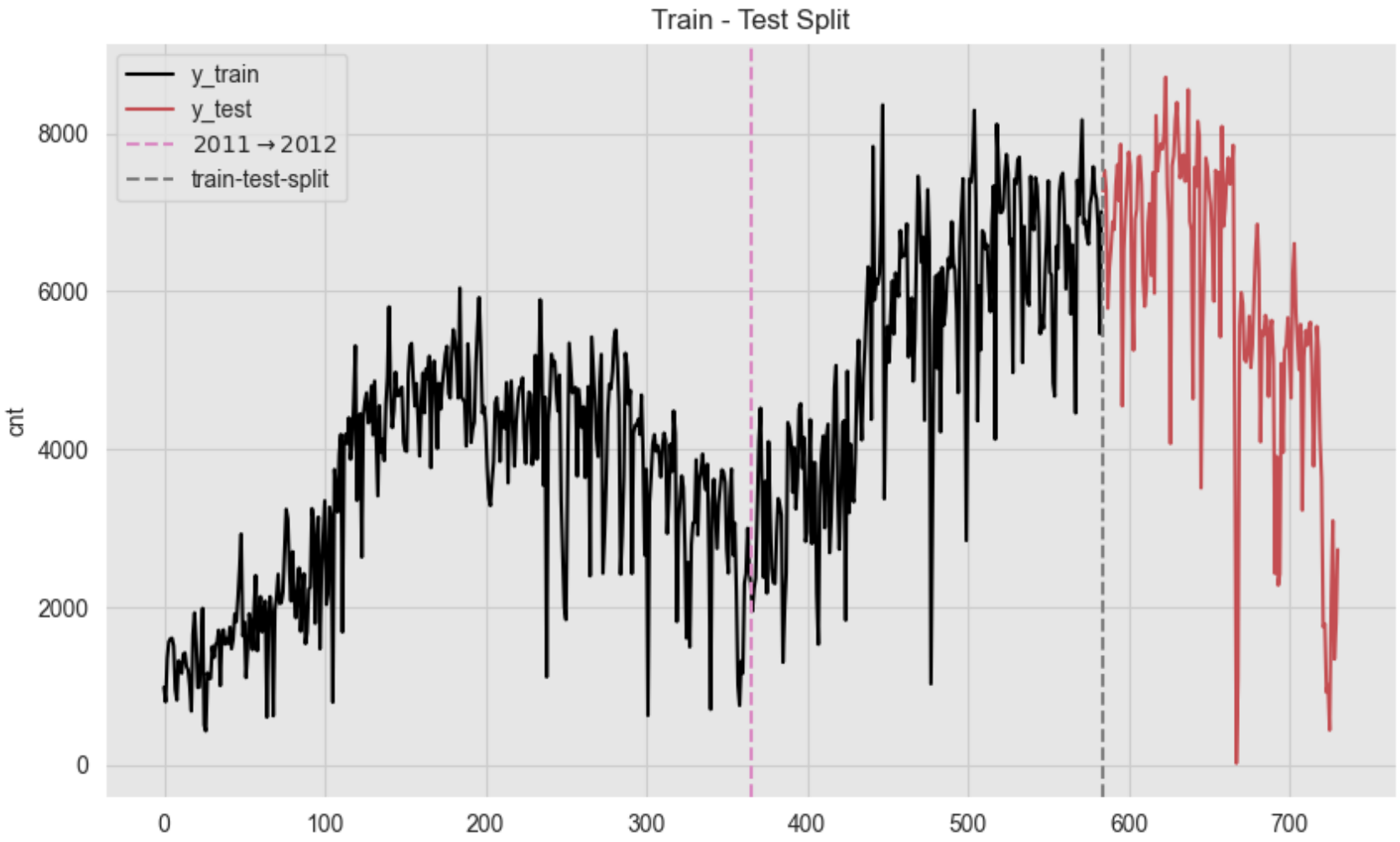
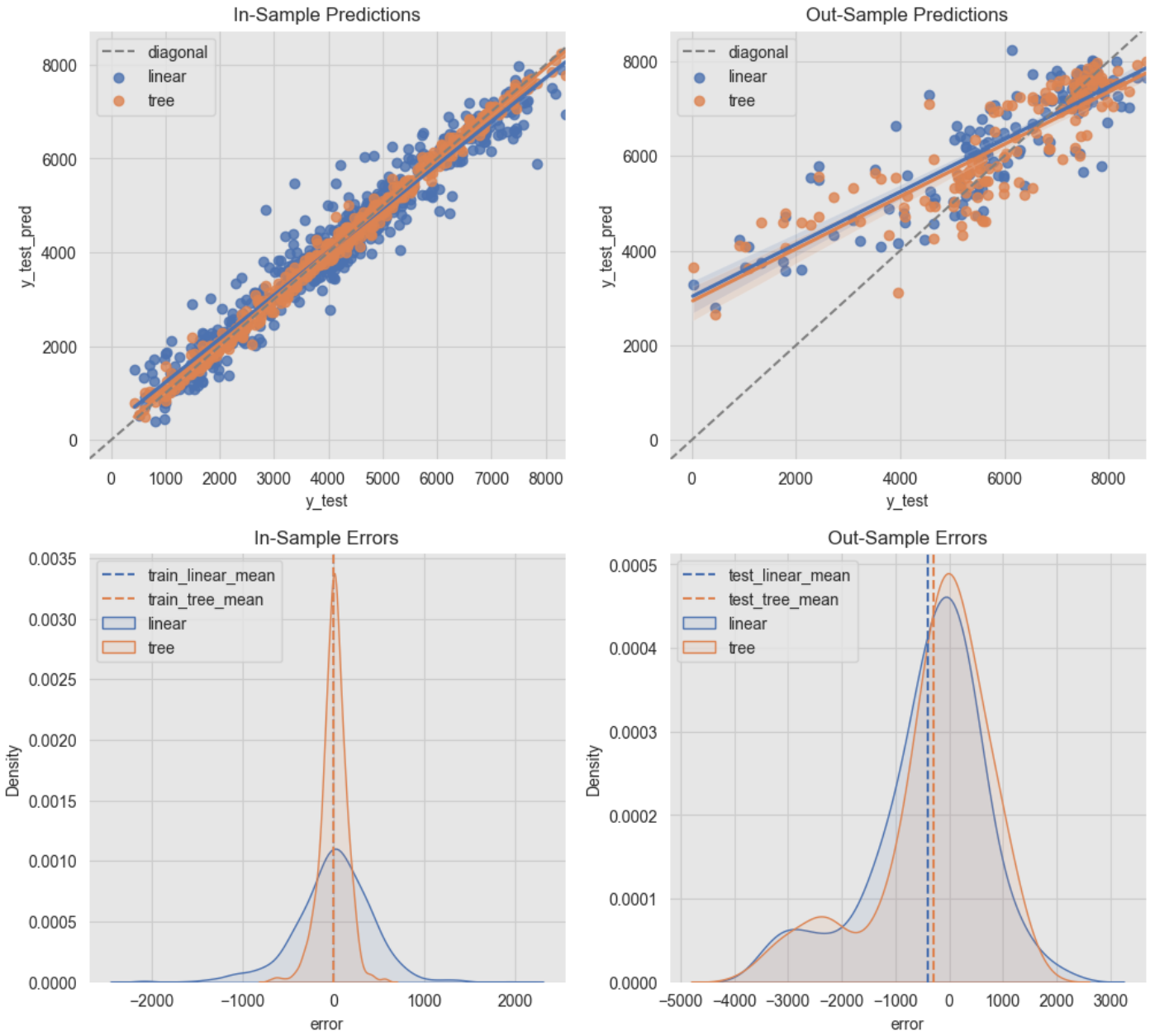
Train-Test Split

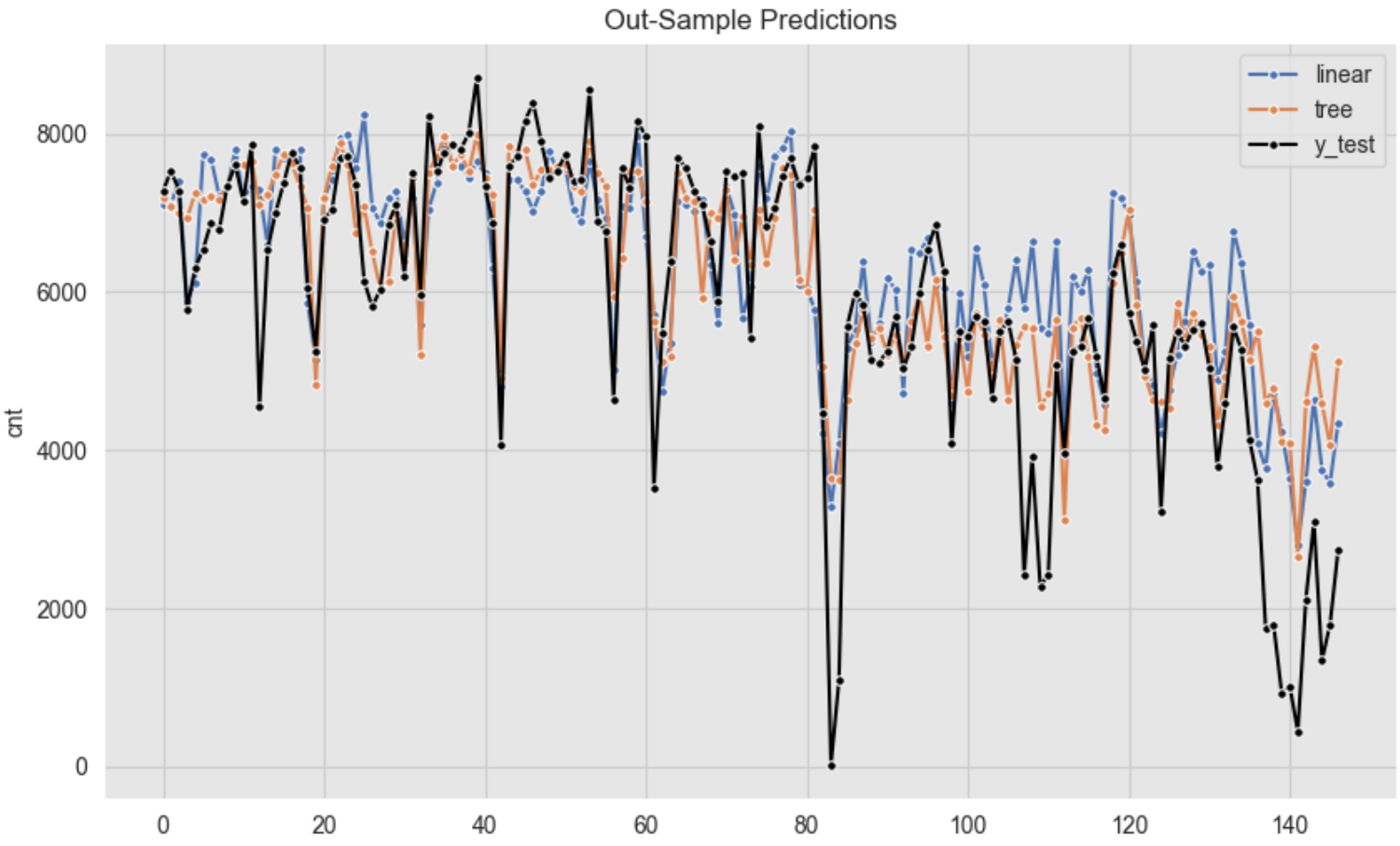


Models

Out of sample performance - Erros Distribution



Out of sample performance - Predictions



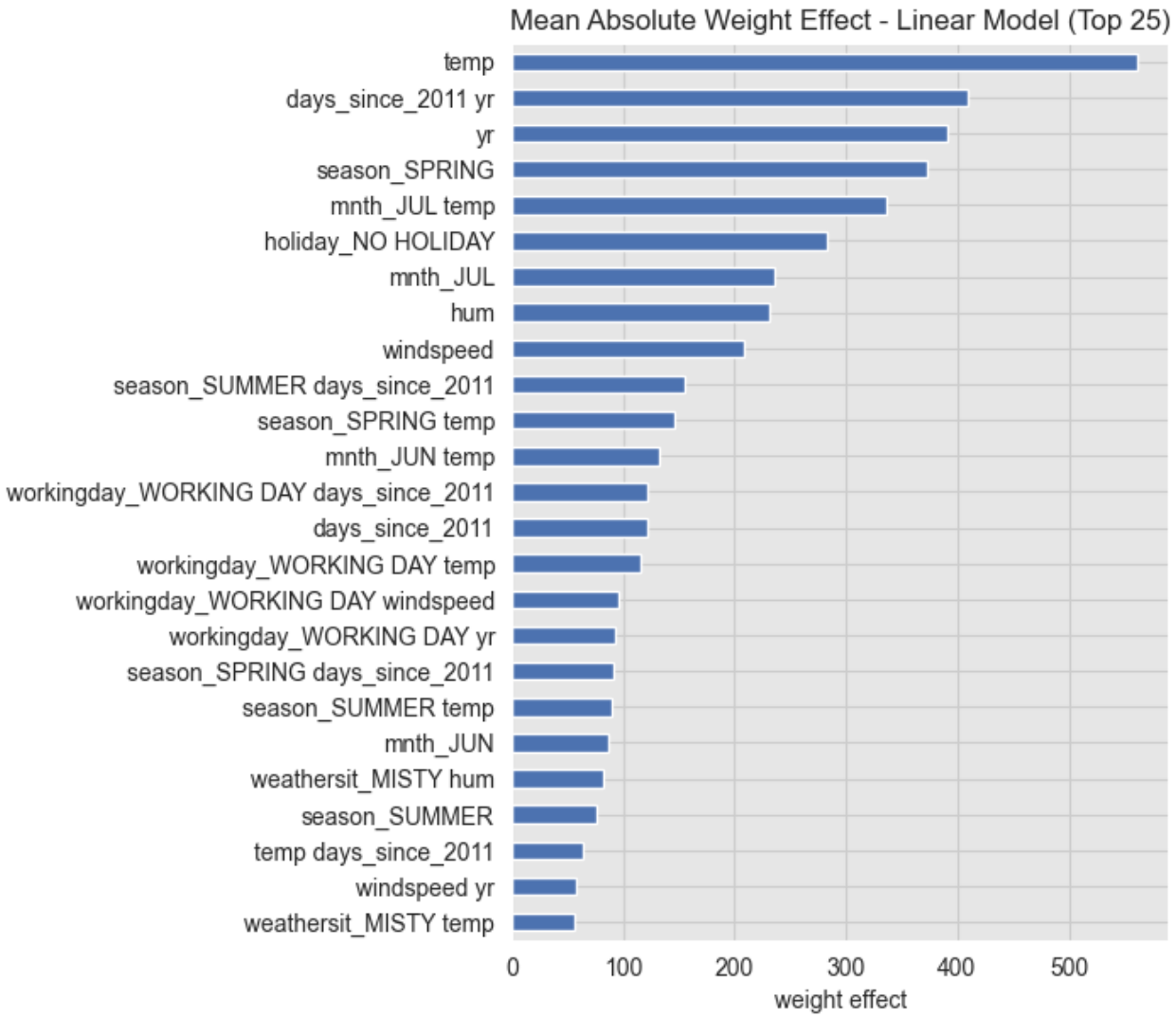
β coeffiecients

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p + \varepsilon, \quad \text{where} \quad \varepsilon \sim N(0, \sigma^2)$$

	linear_features	coef_	abs_coef_
0	mnth_JUL temp	-2305.096894	2305.096894
1	mnth_JUL	2227.672335	2227.672335
2	weathersit_RAIN/SNOW/STORM	-1710.469071	1710.469071
3	mnth_JUN temp	-1299.644413	1299.644413
4	season_SPRING	-1279.629779	1279.629779
5	mnth_JUN	845.229031	845.229031
6	temp	646.609622	646.609622
7	mnth_AUG temp	-523.011653	523.011653
8	season_SUMMER temp	489.319256	489.319256
9	weathersit_RAIN/SNOW/STORM temp	-482.660271	482.660271
10	season_SPRING temp	465.512410	465.512410
11	days_since_2011 yr	465.079169	465.079169
12	weekday_SUN weathersit_RAIN/SNOW/STORM	-462.286059	462.286059
13	season_SUMMER days_since_2011	454.137278	454.137278
14	mnth_MAY temp	-445.268148	445.268148
15	season_SUMMER weathersit_MISTY	-408.809531	408.809531
16	mnth_MAY weathersit_MISTY	404.790954	404.790954
17	yr	403.199142	403.199142
18	season_SUMMER weathersit_RAIN/SNOW/STORM	-394.157306	394.157306
19	mnth_DEZ temp	363.222114	363.222114

Weight Effects $\beta_i x_i$

Weight Effects Importance $w_i = \frac{1}{n}\sum_{i=1}^{n} |\beta_i x_i|$



Weight Effects: Temperature (z-transform)

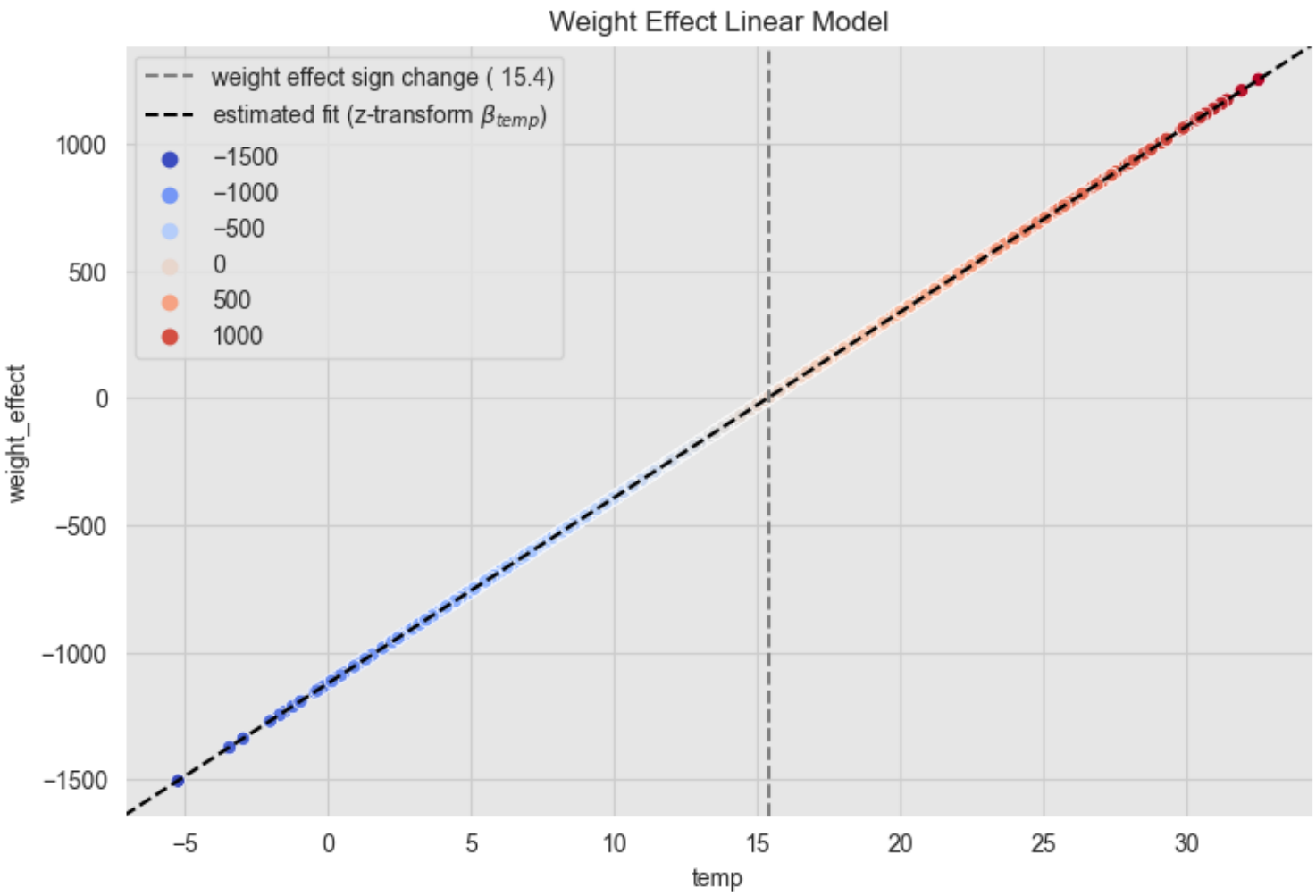


Figure: This plot just shows the effect of the linear term *temp* and not the interactions.

Weight Effects: Interatctions

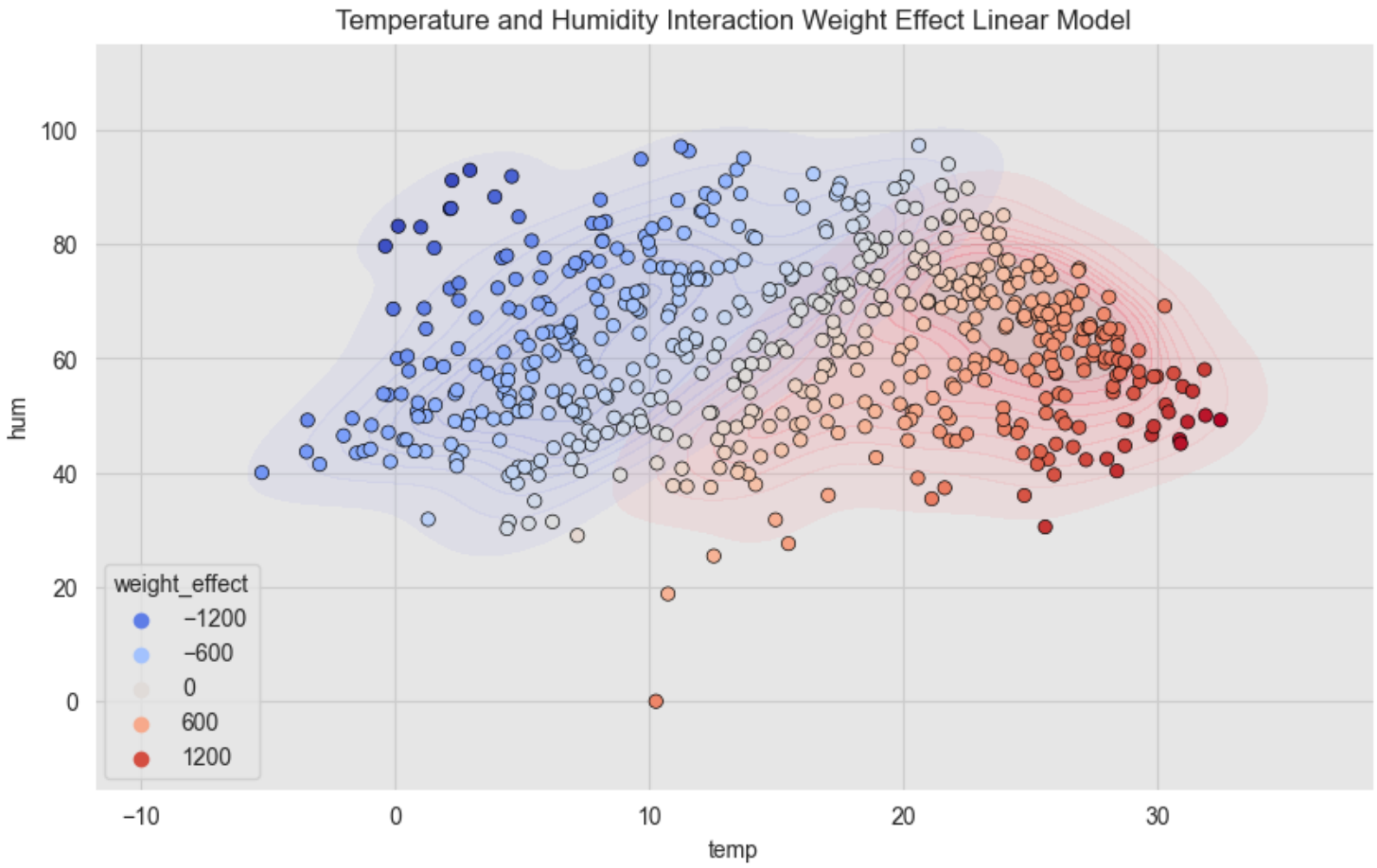
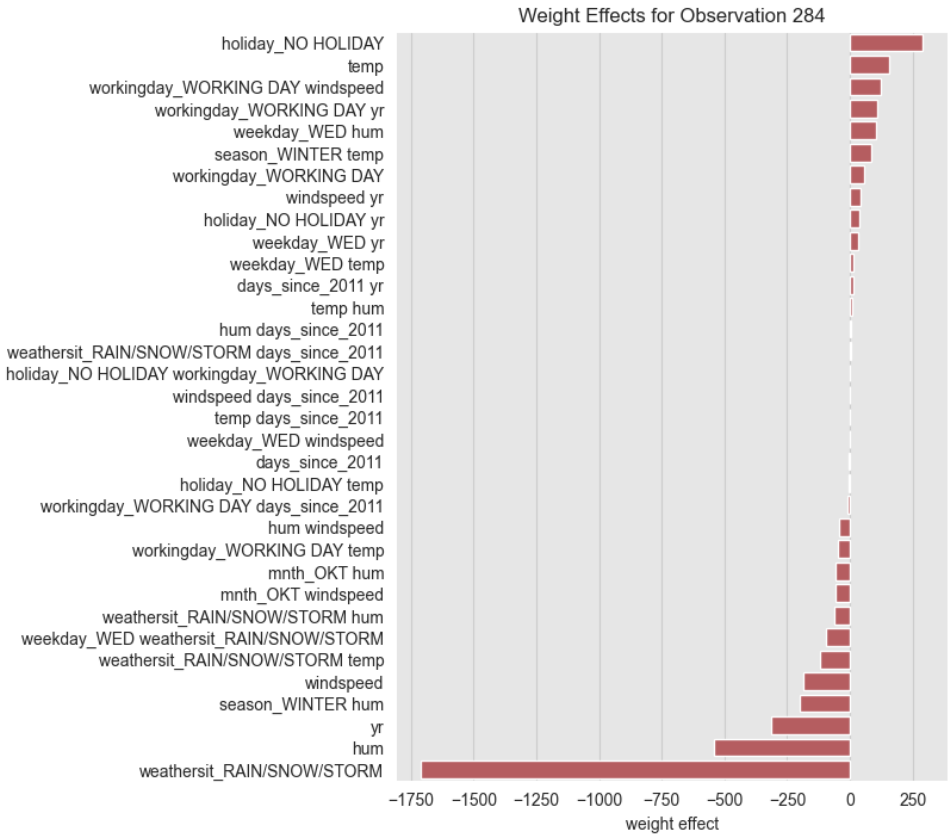
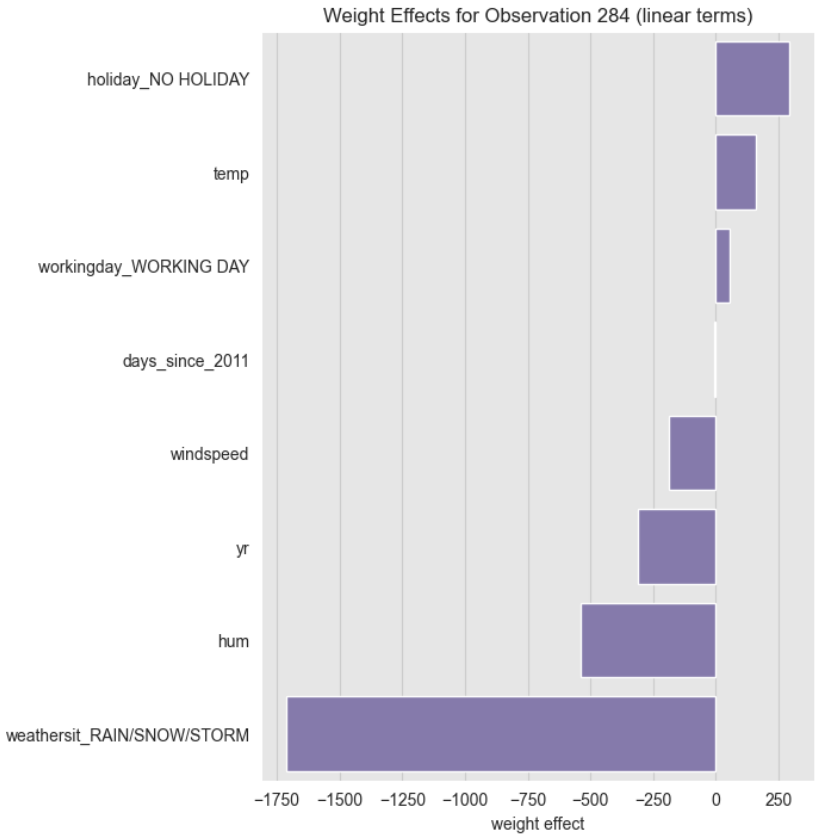


Figure: We can visualize the interaction between *temp* and *hum* by computing the total weight effect as $\beta_{temp}x_{temp} + \beta_{hum}x_{hum} + \beta_{temp \times hum}x_{temp}x_{hum}$.

Explaining Individual Predictions





References I

[1] Juan Orduz.
Exploring tools for interpretable machine learning.
https://juanitorduz.github.io/interpretable_ml/, Jul 2021.

Thank You!

Contact

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