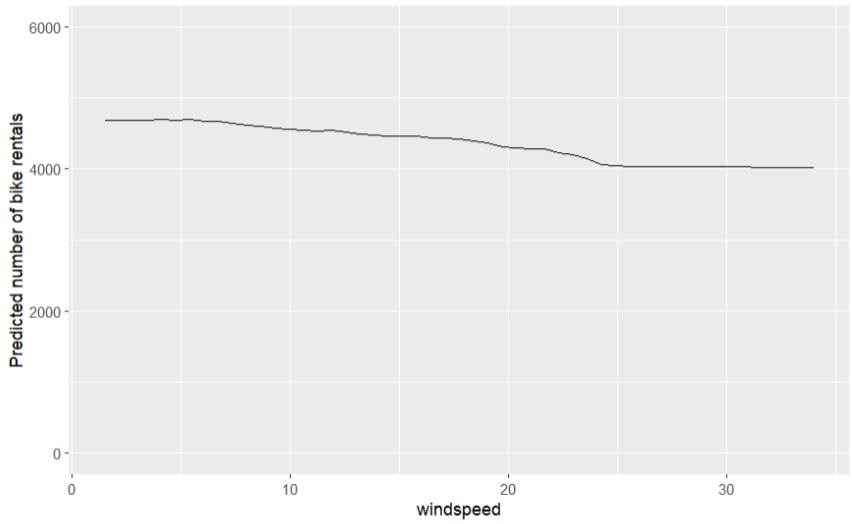
XAI: Model-agnostic methods

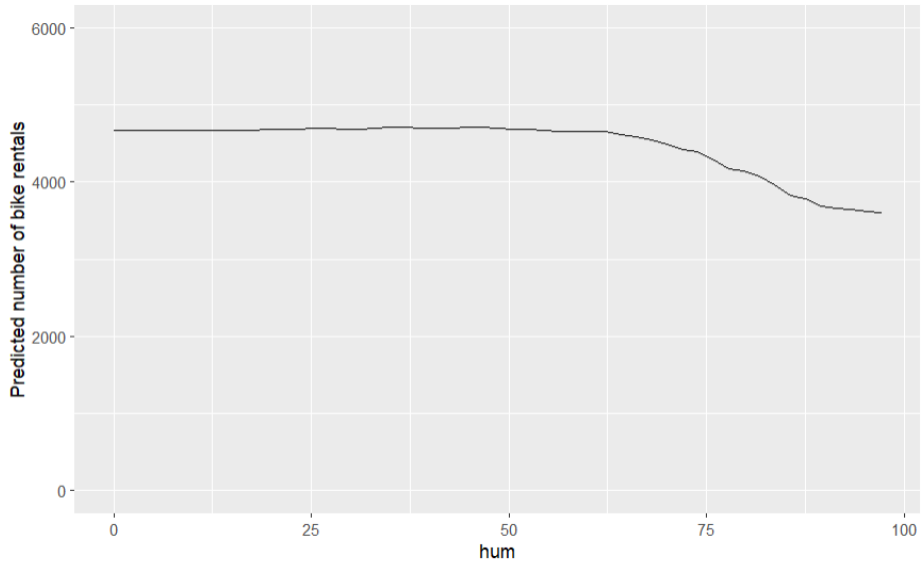
In the rapidly evolving field of Explainable Artificial Intelligence (XAI), model-agnostic methods have gained significant traction for their ability to interpret complex machine learning models without being tied to any specific algorithm. This report delves into various model-agnostic techniques, with a particular focus on Partial Dependence Plots (PDPs), both one-dimensional and bidimensional, to provide insights into model behavior and decision-making processes.

1.- One dimensional Partial Dependence Plot.

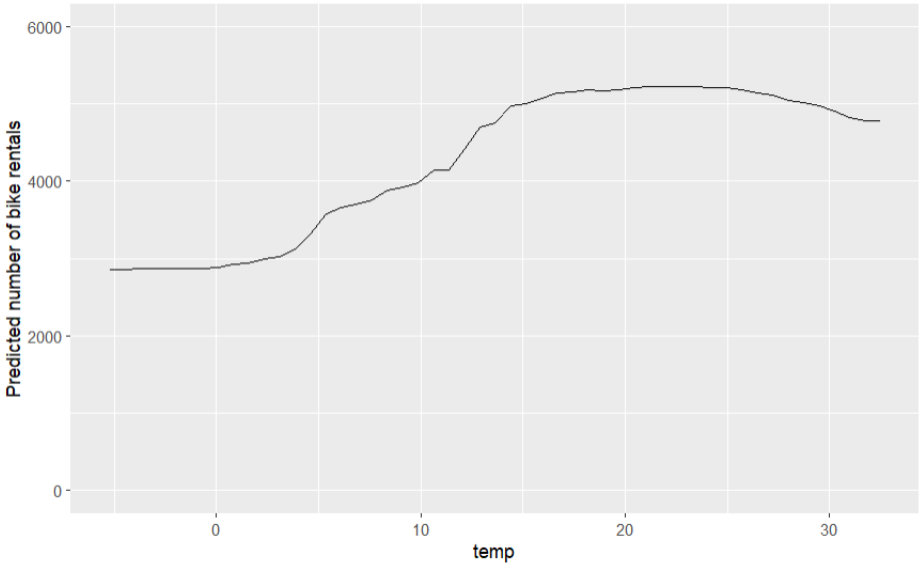
The partial dependence plot shows the marginal effect of a feature on the predicted outcome of a previously fit model.



The graph suggests that there is a negative relationship between wind speed and the number of bike rentals: as wind speed increases, the number of bike rentals decreases smoothly. This could be because cyclists find it less appealing or more challenging to rent bikes in stronger wind conditions.

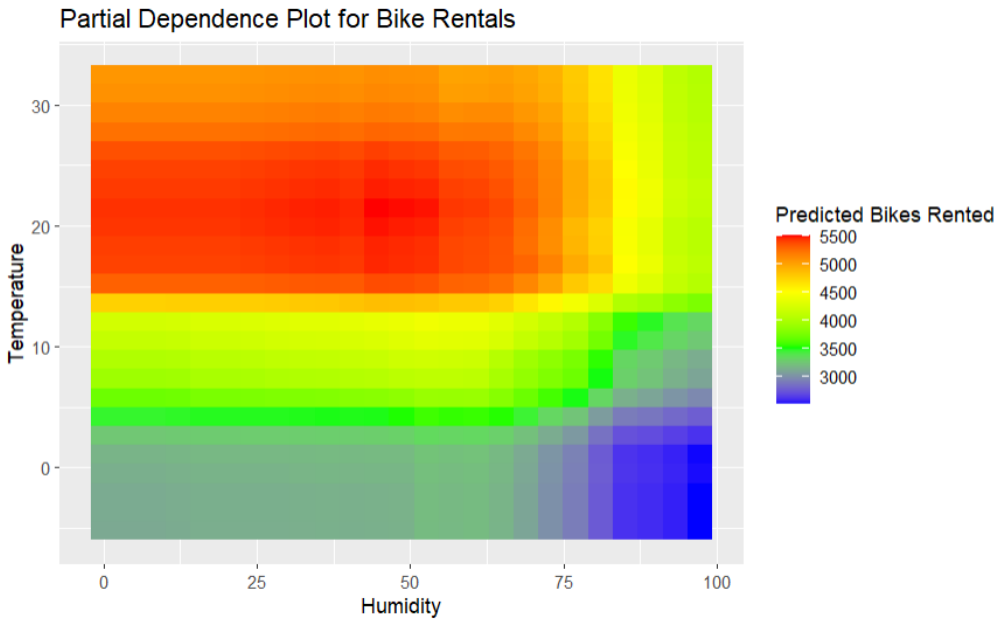


The graph suggests that there is a negative relationship between humidity and the number of bike rentals: as humidity increases, the number of bike rentals decreases, especially when humidity exceeds 50%. This could be because cyclists find it less appealing or more uncomfortable to rent bikes in high humidity conditions, possibly due to the physical discomfort associated with humid weather.



The graph suggests that there is a nonlinear relationship between temperature and the number of bike rentals: the number of rentals increases with the rise in temperature up to a certain point (around 20-25 degrees), after which it starts to decrease. This indicates that moderate temperatures are more favorable for bike rentals, while extreme temperatures, whether very low or very high, tend to reduce the number of rentals.

2.- Bidimensional Partial Dependency Plot.



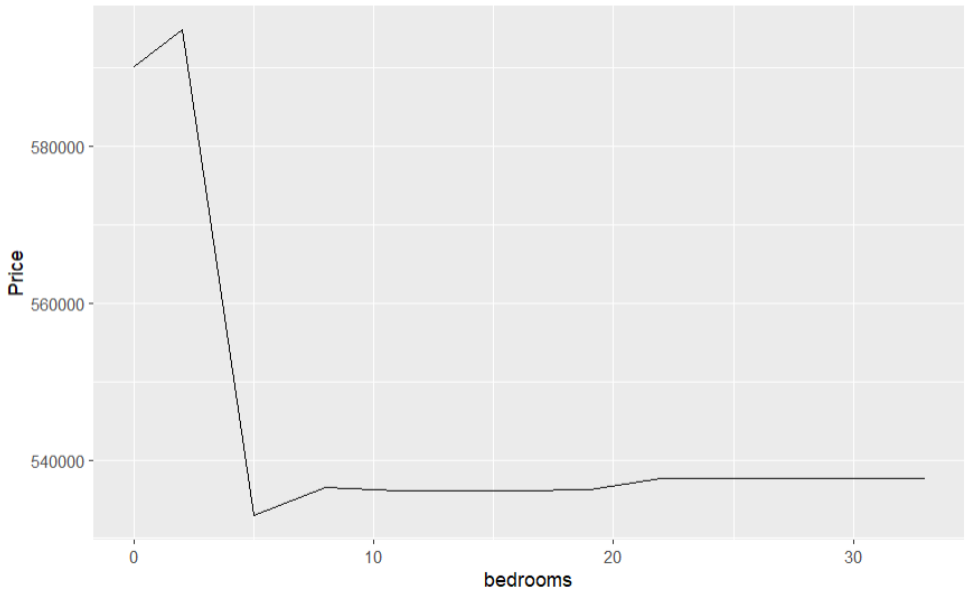
Conclusions:

Optimal Conditions: Optimal conditions for bike rental appear to be warm temperatures (20°C to 30°C) and moderate humidity (40% to 70%).

Non-Optimal Conditions: Less favorable conditions include cold temperatures and high humidity, as well as extreme humidity, which significantly reduces the number of bike rentals.

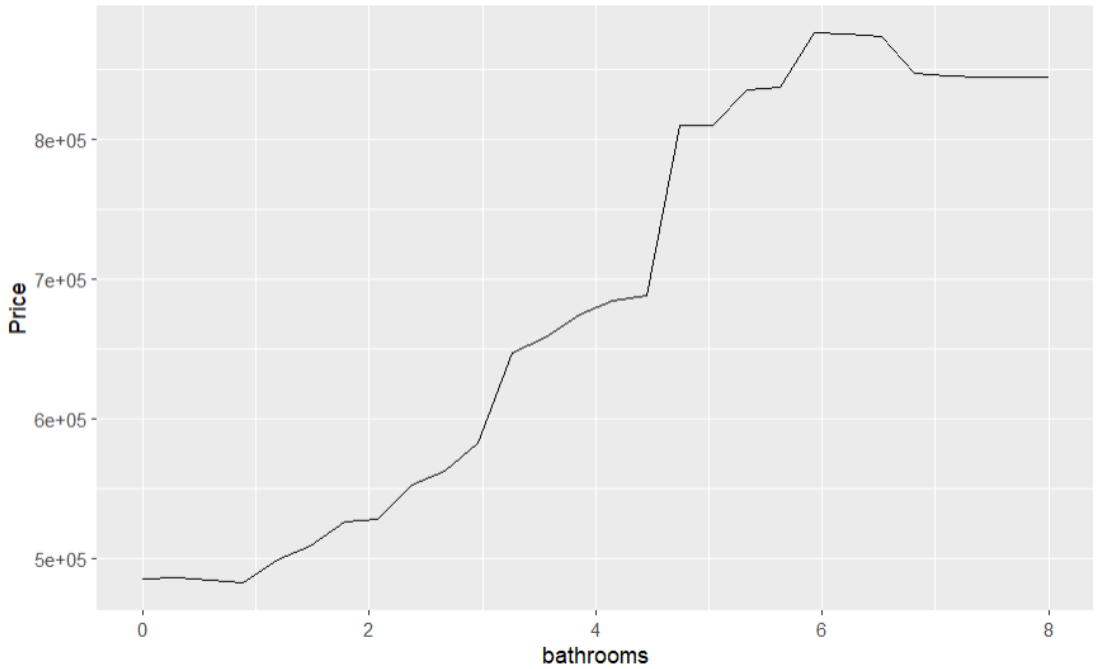
This analysis enables bike rental companies and urban planners to better understand how weather impacts bike demand and plan accordingly, whether by adjusting bike availability based on weather forecasts or promoting bike usage in optimal weather conditions.

3.- PDP to explain the price of a house.



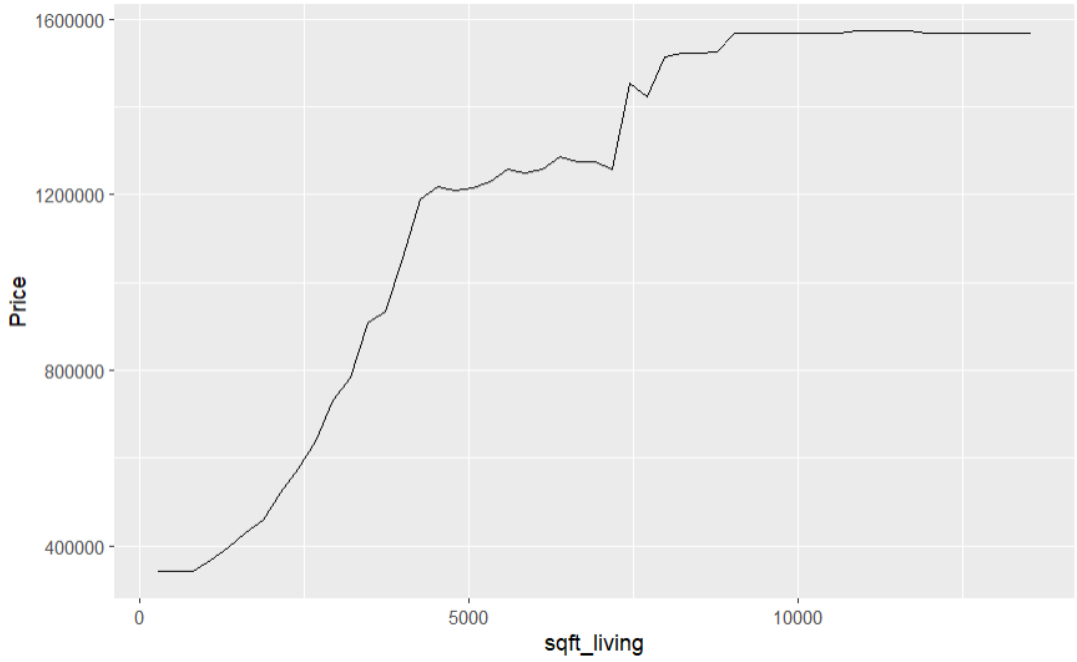
Initial Impact of Bedroom Count: The number of bedrooms has a significant initial impact on price, especially when transitioning from 1 bedroom to 2, where the price decreases considerably.

Price Stability with More Bedrooms: For homes with more than 2 bedrooms, the price remains stable, suggesting that additional factors beyond bedrooms play a more crucial role in determining price.

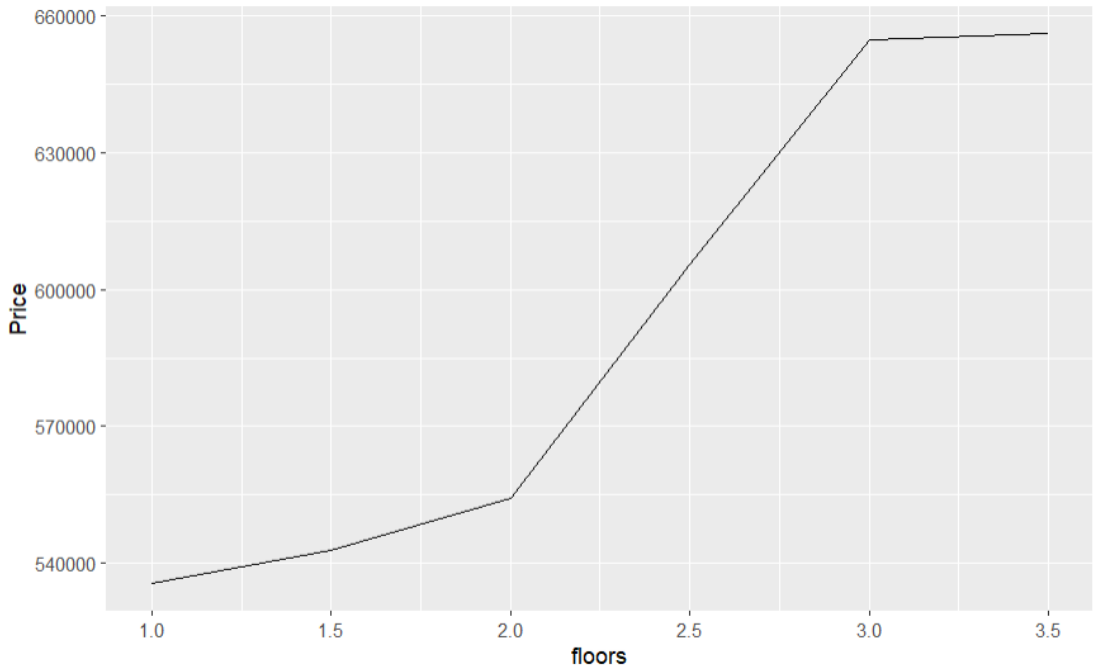


The graph suggests that adding bathrooms to a property generally increases its value up to a certain point. The most significant price increase occurs when moving from 4 to 5 bathrooms. However, beyond 6 bathrooms, the added value diminishes, and prices tend to stabilize or

slightly decline. This could imply a saturation point where additional bathrooms no longer significantly impact the overall property value.



The graph indicates that increasing the square footage of living space generally leads to higher property prices. The most substantial price growth occurs between 1000 and 5000 sqft. Beyond 6000 sqft, the increase in price tends to plateau, suggesting diminishing returns for very large living spaces. This plateau implies that while larger homes do command higher prices, the rate of price increase slows significantly after reaching a certain size threshold.



Impact of Floors on Price: The number of floors in a house has a clear positive impact on its price. More floors generally lead to higher prices.

Significant Price Increase: Adding more floors, particularly from 2.5 to 3 floors, significantly increases the price, suggesting that buyers place high value on additional vertical space in homes.

Stabilization: After 3 floors, the price increase stabilizes, indicating that other factors might start to play a more significant role in determining the house price beyond this point.