Data Exploration

Bike Sharing Rental Data Exploration

Average Bike Rentals

4.50K

By Season

All

By Weather

All

By Day

All

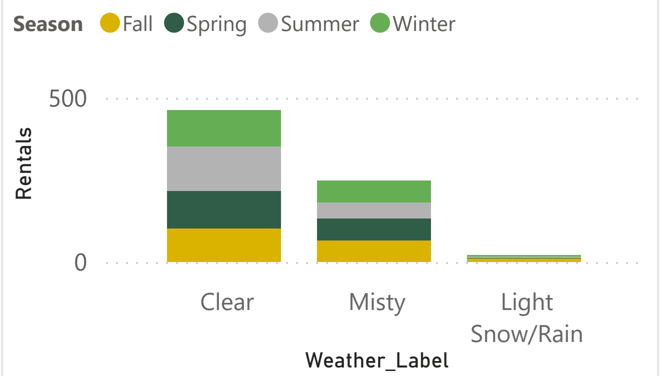
By Holiday

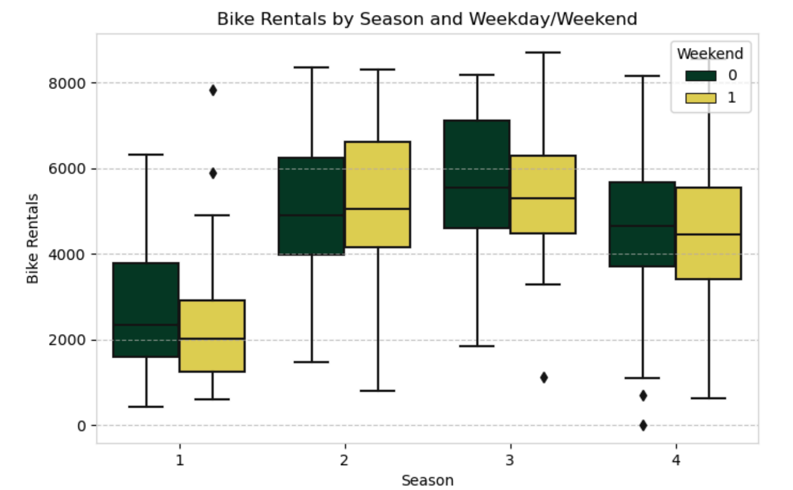
All

Average Monthly Rental

Month	Rental
12	3403.81
11	4247.18
10	5199.23
9	5766.52
8	5664.42
7	5563.68
6	5772.37
5	5349.77
4	4484.90

Bike Rentals By Season vs Weather

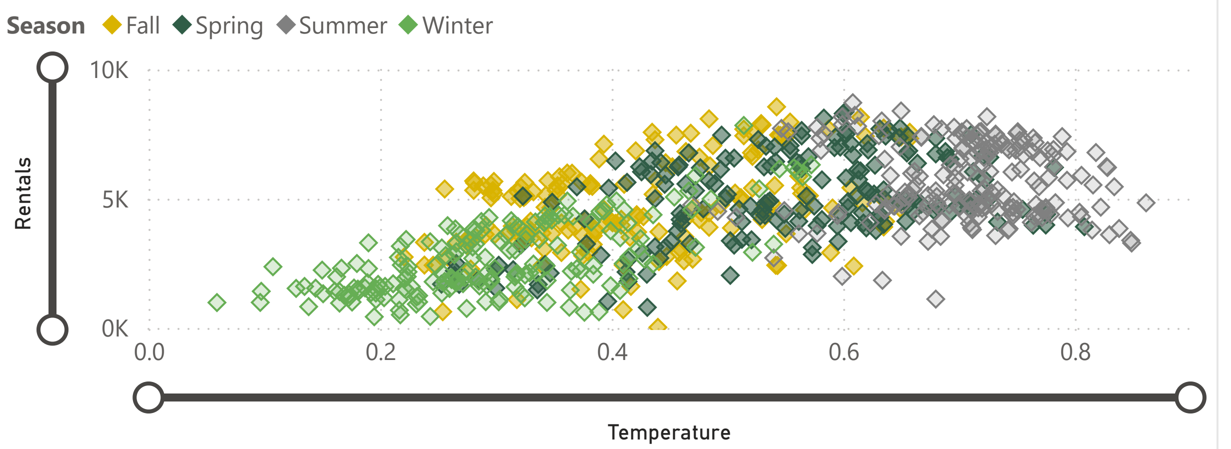




Data Insights

- Temperature strongly influences rentals; warmer weather increases demand.
- Weekend rentals consistently exceed weekday usage, particularly in warmer seasons.
- Clear weather significantly boosts rentals; adverse conditions sharply reduce demand.
- Temperature, humidity, and wind speed distributions are balanced, indicating good data quality.
- Temperature is most correlated with rentals, highlighting its predictive significance..

Bike Rentals By Temparature



Prescriptive Dashboard

Optimal Bike Allocation: Optimizing Cost Savings & Smart Demand Planning

Savings From Optimal Allocations

37M

By Season

All

By Weather

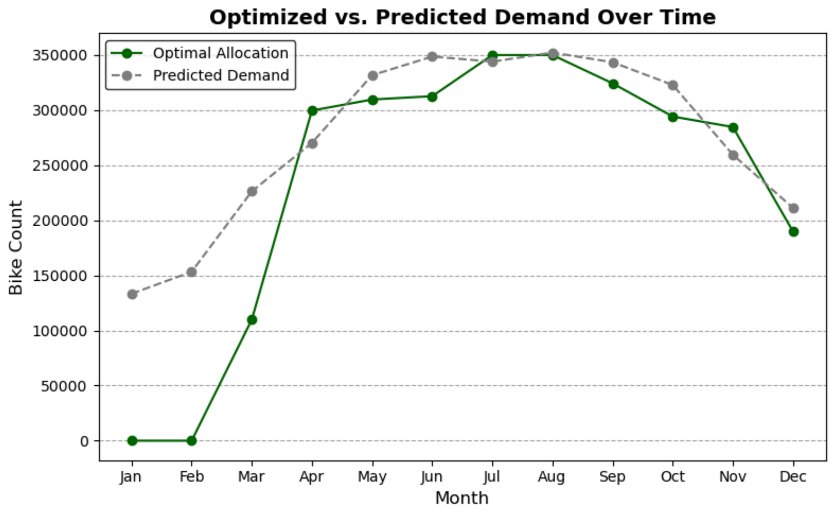
All

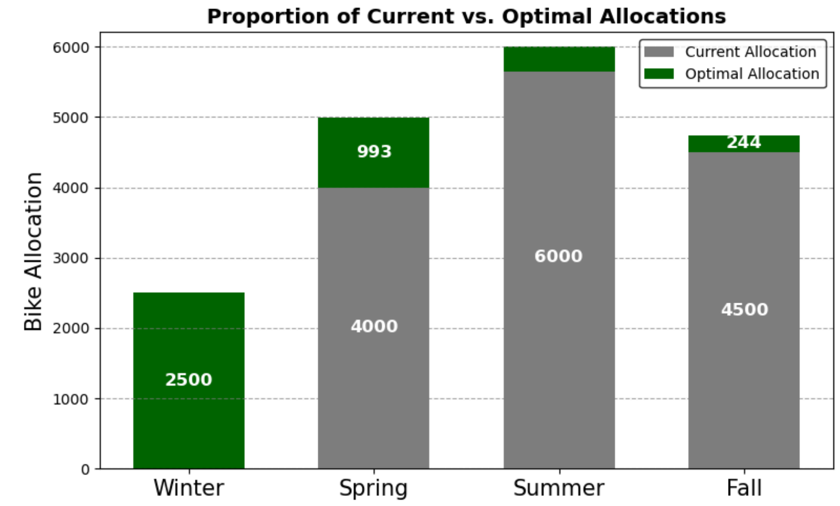
By Day

All

By Holiday

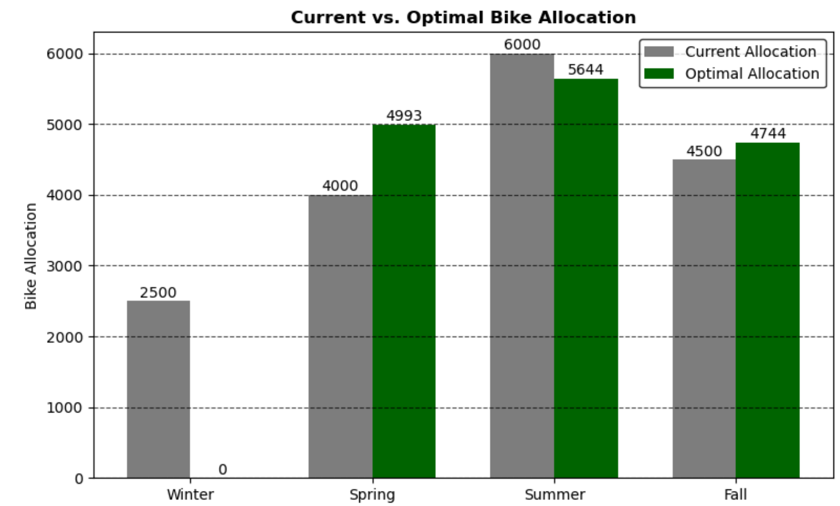
All



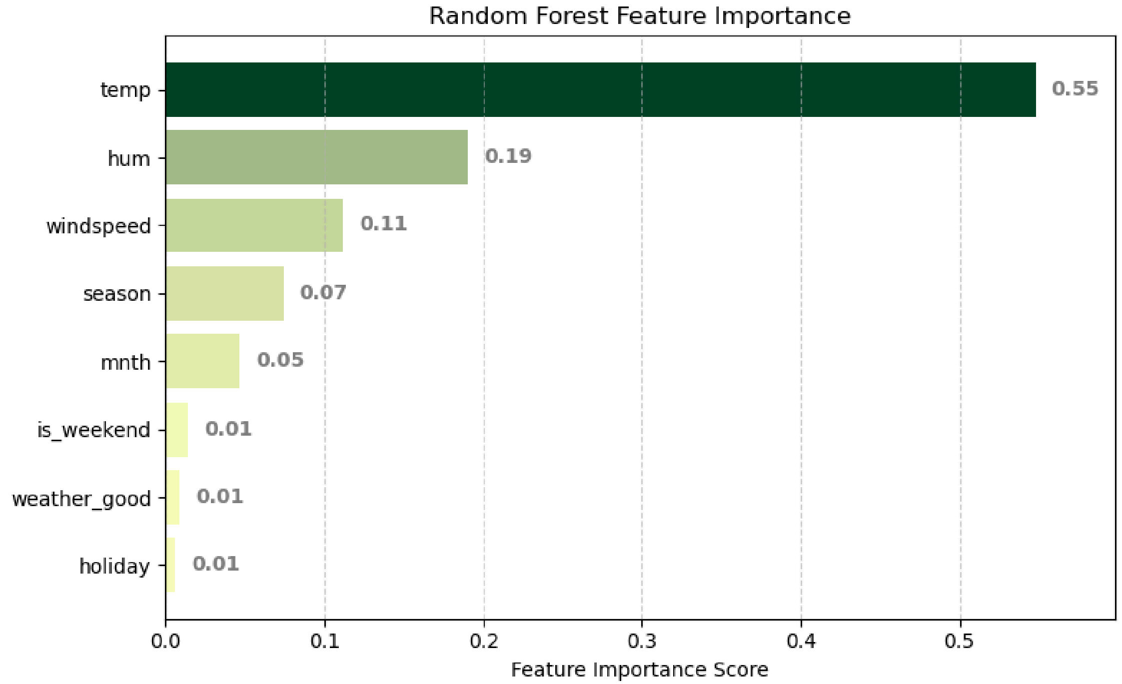


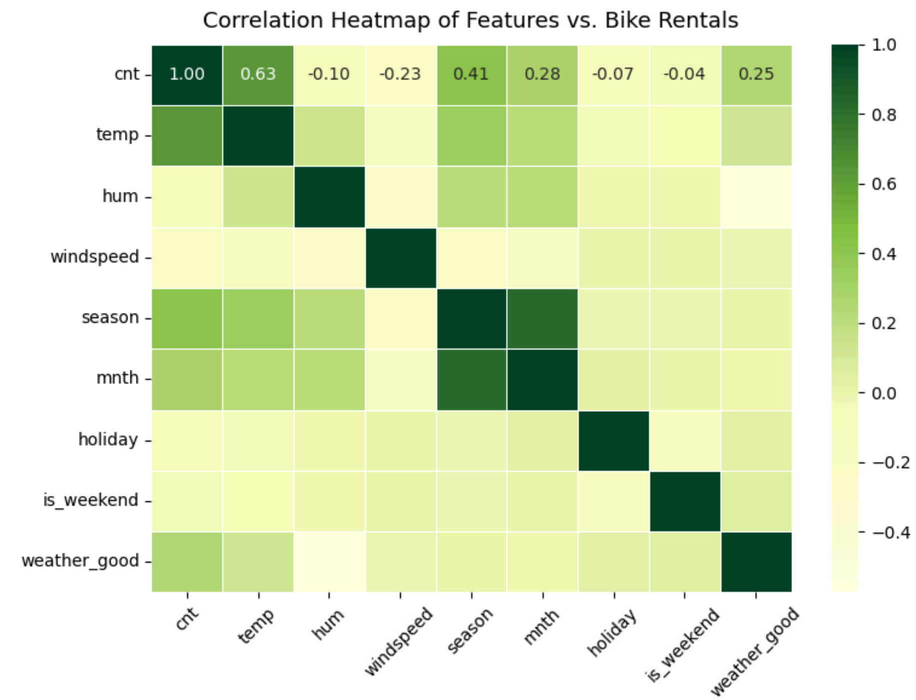
Actionable Recommendations

- Increase bike allocation in Spring & Summer to meet high demand.
- Reduce Winter allocation to minimize excess inventory costs.
- Adjust forecasting for Jan-March to better match rising demand.
- Use real-time rental data to refine allocation strategies dynamically.
- Explore seasonal promotions to boost bike usage in low-demand months.
- Monitor actual vs. optimized performance to continuously improve allocation.



Feature Importance Analysis
for Regression Modelling





Random Forest Feature Importance

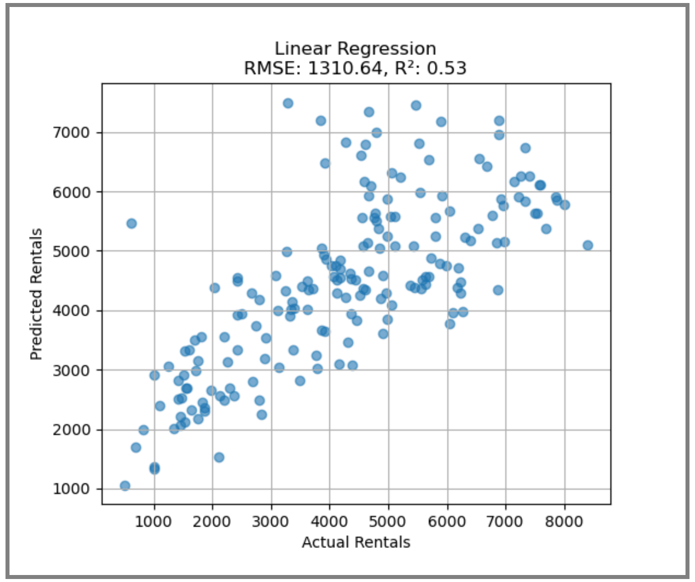
This chart displays the feature importance scores assigned by the Random Forest model. Higher scores indicate greater influence on predicting bike rental counts . Temperature clearly stands out as the most impactful feature, followed by humidity and wind speed. Features like holiday, is_weekend, and weather_good contribute less to the prediction, but may still add contextual value. This justifies the selection and weighting of features in our regression model.

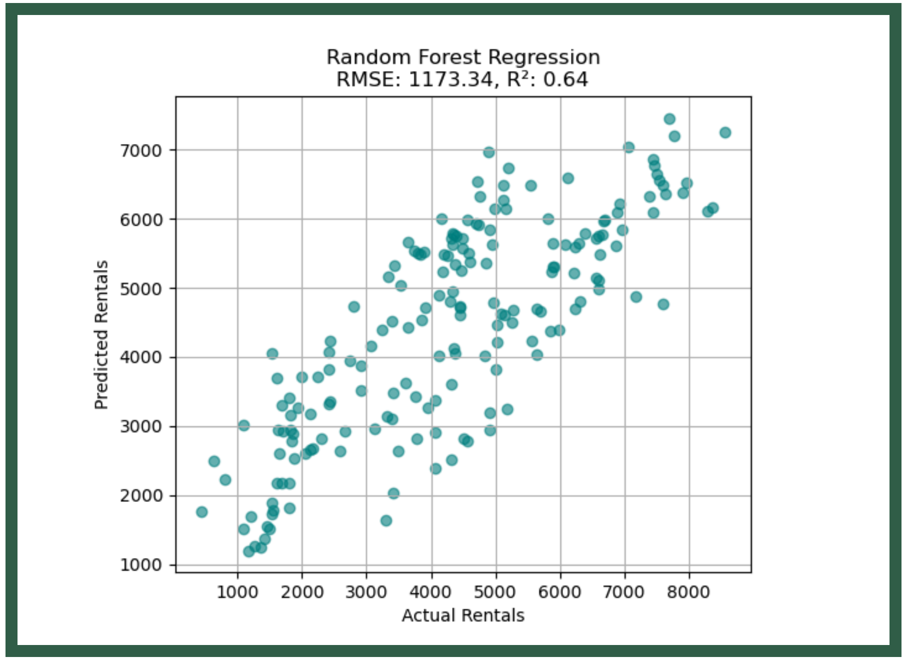
Correlation Heatmap of Features vs. Bike Rentals

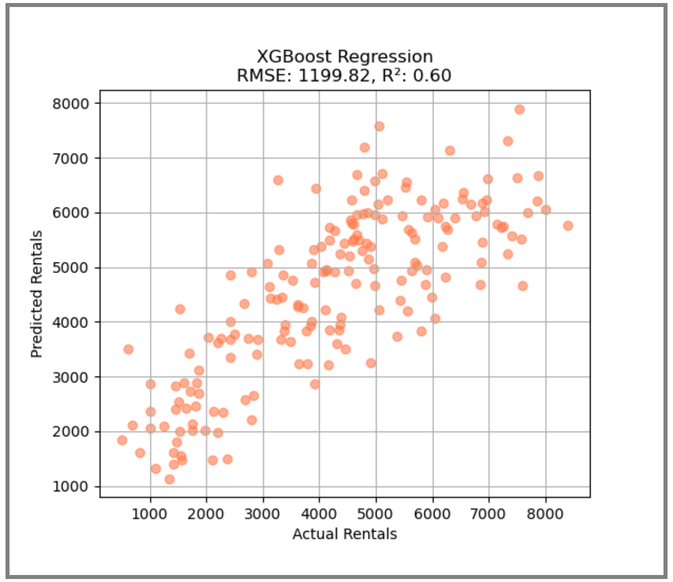
The heatmap illustrates the strength and direction of linear relationships between features and bike rentals. Temperature shows the strongest positive correlation (0.63), reinforcing its predictive importance. Humidity and wind speed show weaker correlations, while seasonal and temporal features (month, season) also show meaningful associations. While correlation does not equal causation, it supports feature relevance and complements the model-driven importance scores.

Regression Model Comparison

Actual vs Predicted Bike Rentals







Linear Regression

Linear Regression had the lowest performance (**R^2 = 0.53**), likely due to its inability to capture nonlinear patterns.

Random Forest Regression

Random Forest achieved the highest predictive accuracy (**R^2 = 0.64, RMSE = 1173**), showing a strong fit between predicted and actual rentals.

Conclusion: Random Forest was selected as the final model due to its balance of predictive strength, interpretability, and robustness across seasonal variations.

XGBoost

XGBoost performed slightly lower (**R^2 = 0.60**), still producing a reliable prediction curve.

Predictive Analysis

Using Random Forest Regression Model

Average of Predict Bike Rental Increase

4.51K

Actual: 4.50K (+0.11%)

By Season

All

By Weather

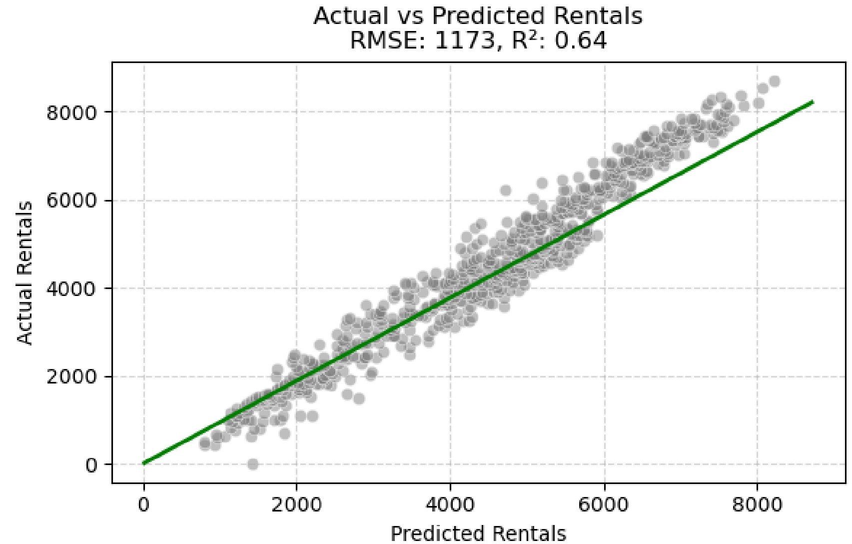
All

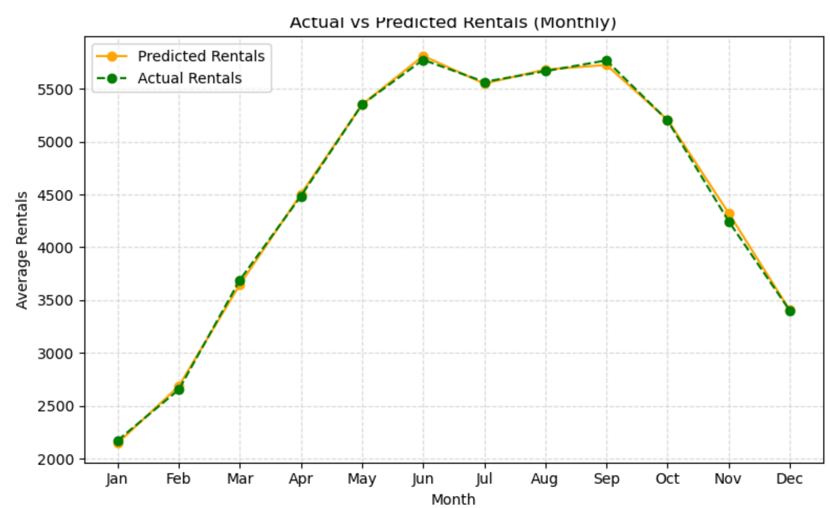
By Day

All

By Holiday

All





Insights

The Random Forest predictive model demonstrates good predictive accuracy. Rentals follow strong seasonal trends, peaking in summer. Actual and predicted counts are highly correlated, though improvements could be made for high-demand days. Consider refining model features or hyperparameters for further accuracy.

The Random Forest predictive model reliably tracks actual rentals closely month-to-month, indicating the model captures seasonality effectively. Slight variations suggest opportunities to improve predictions for peak months.

Summer clearly shows the highest predicted bike rentals, suggesting high demand. Strategic resource allocation during summer months could significantly enhance revenue.