Seattle Parking and Weather Analysis

Uncovering the Hidden Relationship Between Weather and Urban Parking.

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This presentation explores the correlation between Seattle weather patterns and parking availability. We aim to provide insights for city planners and commuters alike. Understanding these dynamics can lead to better urban planning and more efficient commuting.

The Urban Challenge

Seattle drivers spend ~12 minutes searching for parking daily. This contributes to 30% of downtown congestion. Unpredictable parking availability affects commutes. Weather further complicates the parking equation. No integrated system connects these factors.

The Problem

Parking availability is unpredictable. Weather conditions add complexity. No integrated solutions exist.

Our Mission

To uncover how weather shapes parking patterns and create predictive models that can help both drivers and city planners

Our Data Journey

We used 838,840 parking records (2014-2019) and historical weather data from 5 Seattle neighborhoods. This combined dataset includes 26 features. This captures time, location, weather, and parking metrics. The data management approach included cleaning, integration, analysis, and modeling.

1 Data Volume

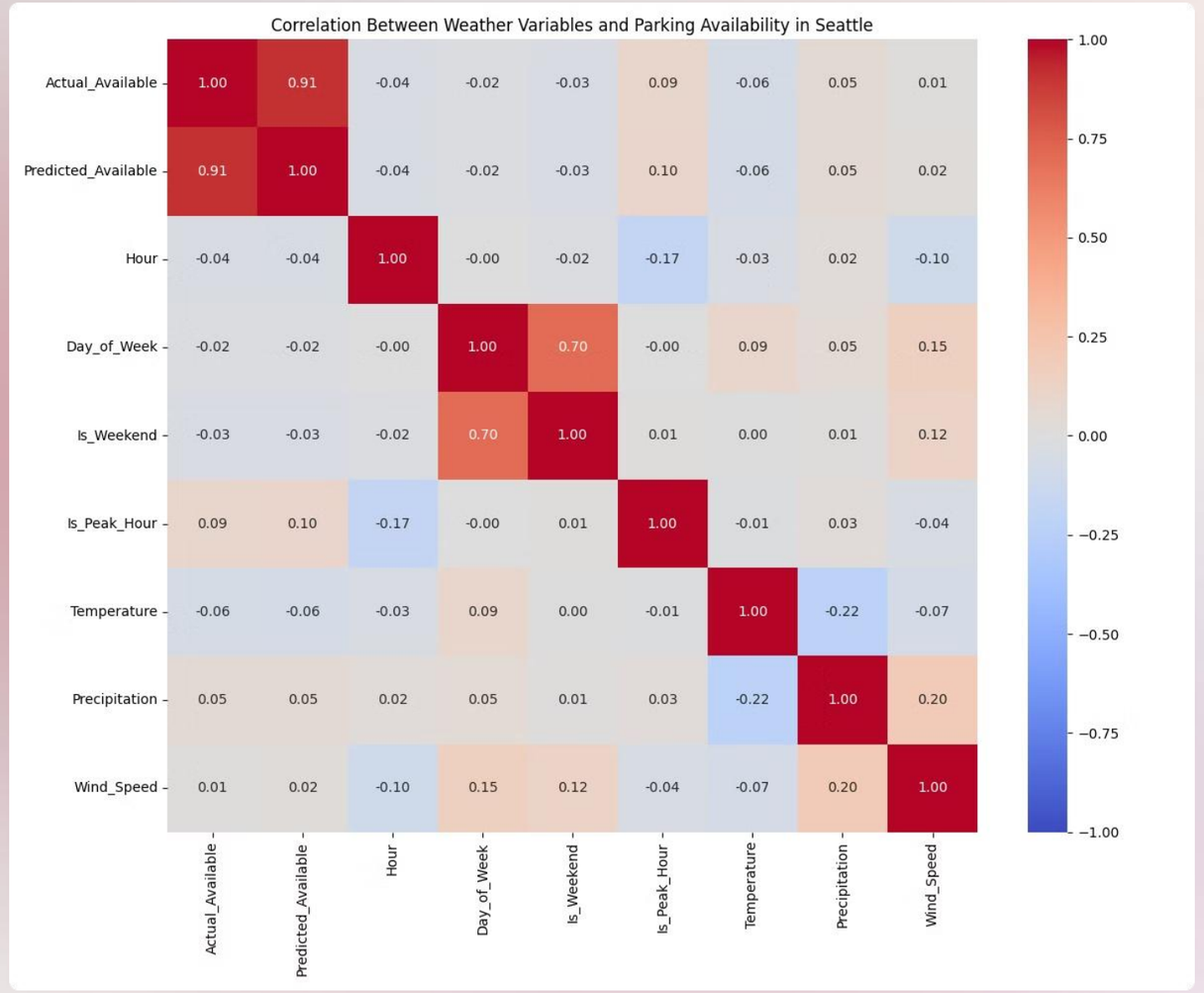
838,840 records.

2 Data Features

26 features.

3 Our Approach

Raw Data →Cleaning → Integration → Analysis → Modeling.



A Tale of Time

Parking occupancy peaks during the morning rush (8-10 AM) at 85-90%. The evening rush (5-7 PM) shows 75-80% occupancy. Tuesday-Thursday are the most congested, averaging 87% occupancy. Sundays offer 42% more availability. Weekdays have 30% higher occupancy than weekends.

Morning Rush

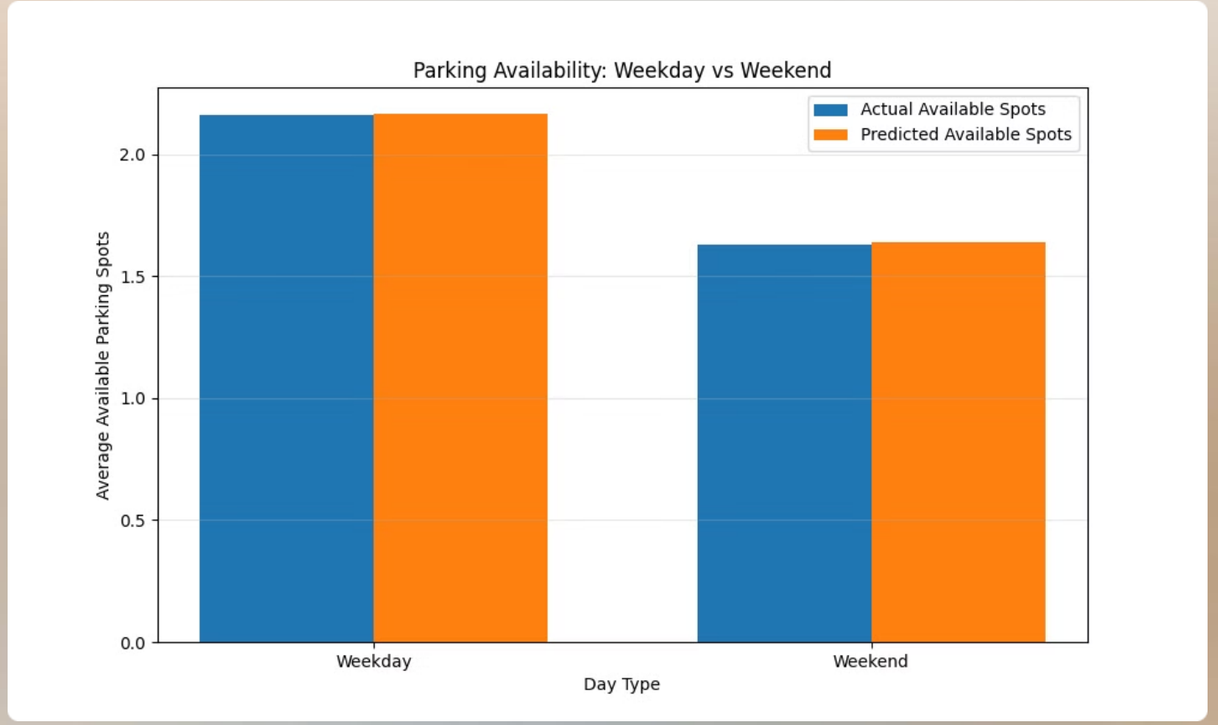
8-10 AM peaks at 85-90%.

Tuesday-Thursday

Most congested, 87% occupancy.

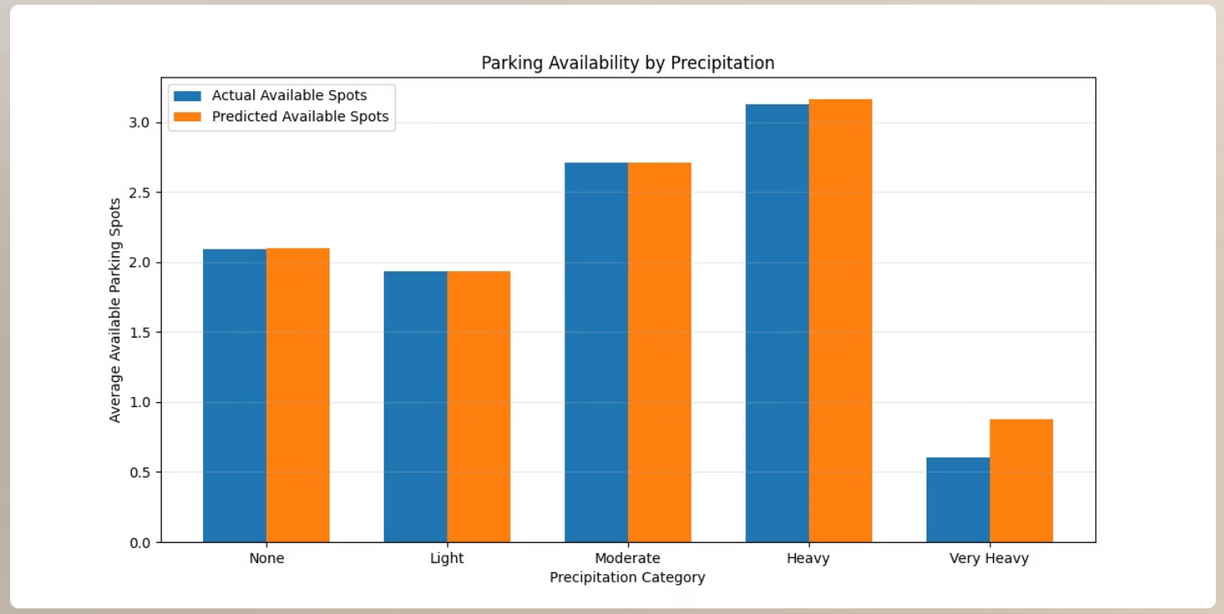
Weekday Difference

30% higher than weekends.



When Rain Falls, Parking Calls

Each mm of rainfall correlates with a 1.2% increase in occupancy. The correlation coefficient between rainfall and parking demand is 0.72. Light rain increases occupancy by 8%. Heavy rain drives a 15-20% surge. **Downtown Seattle** has the strongest rainfall-parking relationship. **Capitol Hill** demonstrates more resilience to precipitation effects



Rain Impact

1.2% occupancy increase per mm.

Rain Threshold

Heavy rain surges 15-20%.

Regional Impact

Downtown is most sensitive.

The Temperature Equation

Optimal parking demand occurs at 10-15°C. The temperature correlation coefficient is -0.45 for extreme temperatures. Below 5°C and above 25°C, parking demand drops by 12-18%. Cold rain creates the highest parking demand. Hot, dry days show the lowest.

1 **Optimal Demand**

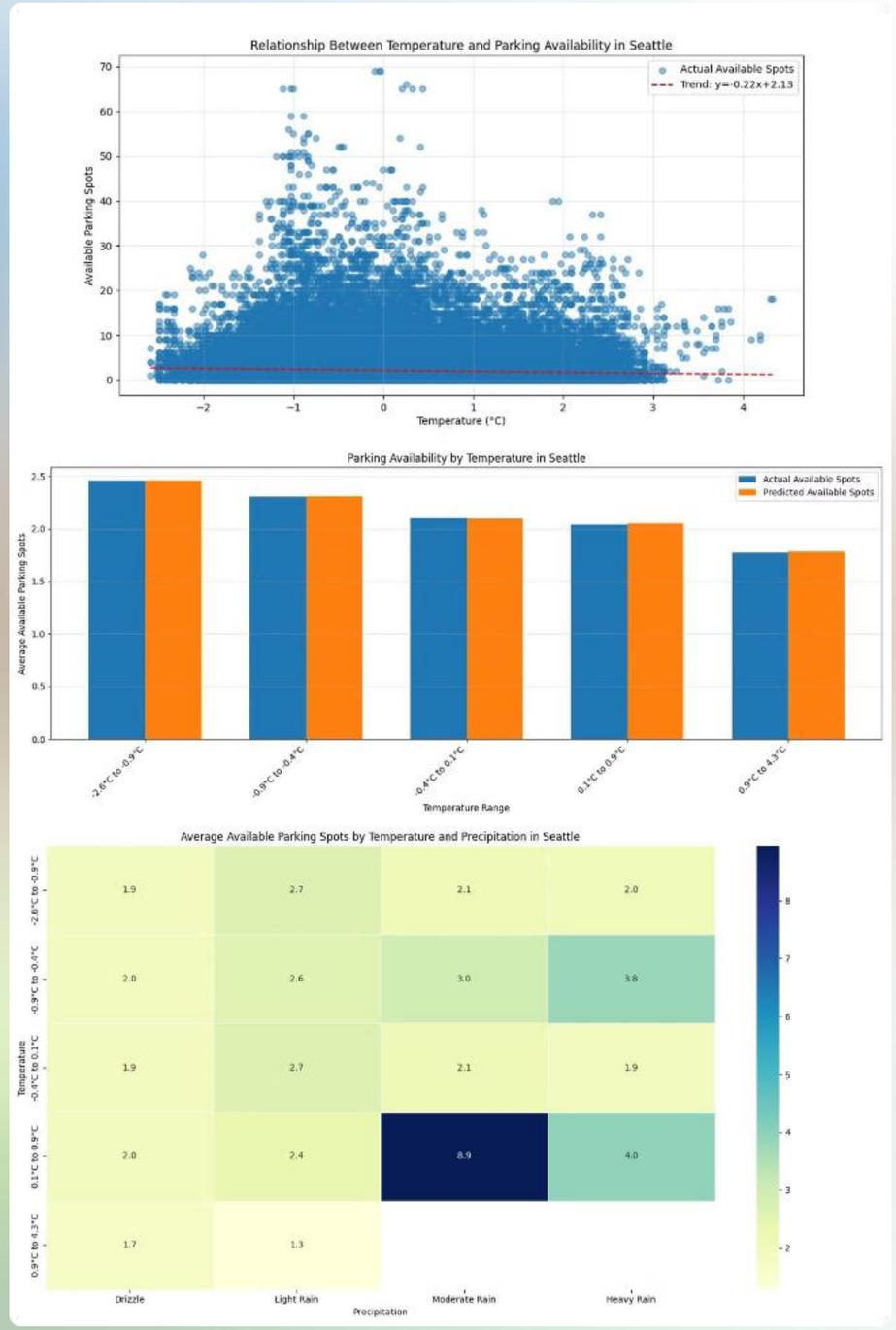
10-15°C parking demand.

2 **Temperature Sensitivity**

Demand drops by 12-18% during extremes.

3 **Combined Effect**

Cold rain drives the highest demand.



Five Neighborhoods, Five Stories

Downtown Seattle has the highest occupancy, sensitive to precipitation. South Lake Union has strong workday patterns. There is a high correlation with temperature. Capitol Hill, Ballard & Industrial District each have unique interactions of weather and parking. Wind speeds impact parking duration.

Downtown Seattle

Highest overall occupancy (85% average) Most sensitive to precipitation (20% increase during rain)

South Lake Union

Strong workday patterns (90% occupancy during business hours) High correlation with temperature

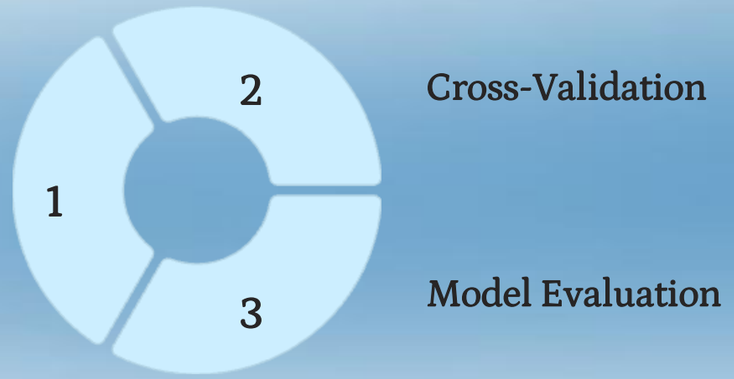
Capitol Hill, Ballard & Industrial District

Each tells a unique story of how weather and parking interact

Predicting the Unpredictable

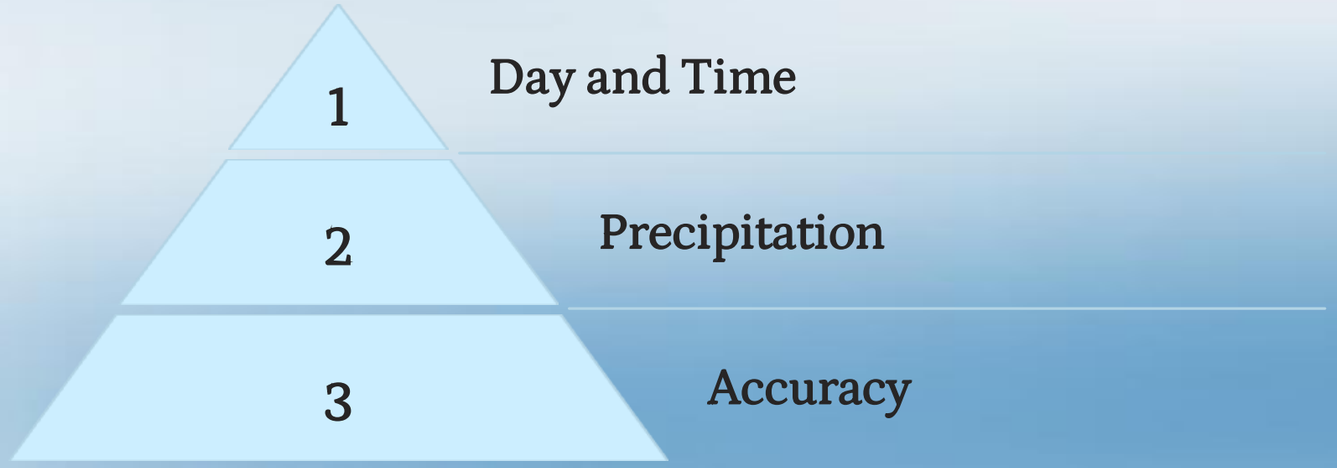
Our modeling approach used 32 engineered features. The process included 10-fold cross-validation. We evaluated three competing models.

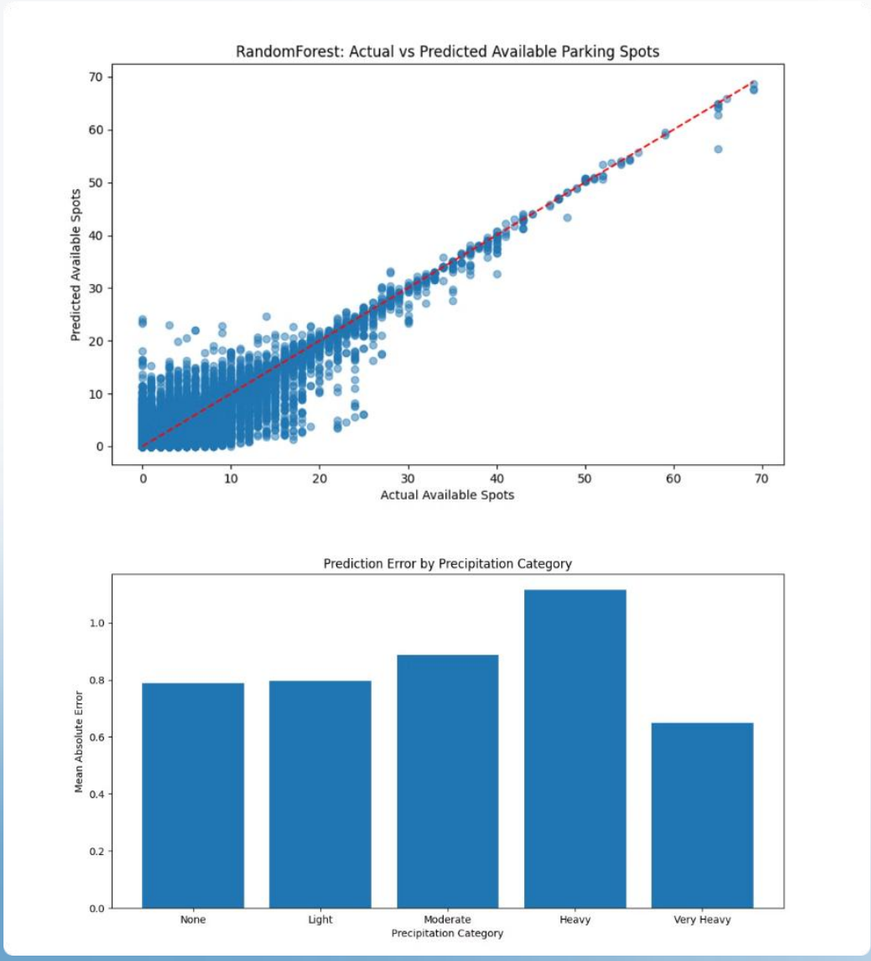
Model	R^2	RMSE
Random Forest	0.8325 ± 0.0038	1.4704 ± 0.0111
XGBoost	0.7389 ± 0.0056	1.8361 ± 0.0110
Gradient Boosting	0.5475 ± 0.0074	2.4171 ± 0.0142



Inside the Crystal Ball

Our model achieves 83% accuracy in predicting parking availability. The hour of the day, precipitation, and day of the week are the top predictors. Extreme weather events show higher prediction errors. The mean squared error is 2.16 overall but rises to 3.07 during extreme weather.





From Insights to Action

Implement dynamic pricing during forecasted rain. Focus weather-responsive planning on Downtown and South Lake Union. Plan for higher occupancy during rain and peak hours.

City Planners

Implement dynamic pricing that increases by 15-20% during forecasted rain. Focus weather-responsive planning on Downtown and South Lake Union. Potential Impact: 30% reduction in parking search time during adverse weather

Commuters

Plan for 15-20% higher occupancy during rain. Consider alternative transportation during 8-10 AM peak (85-90% occupancy)

Future Directions

Real-time dashboard development to monitor parking availability and weather conditions. Integration with traffic and public transit data to provide comprehensive transportation solutions.

Thank You

Questions? Please don't hesitate to ask.