- **Name**: Jagadeeshwari Mandapalli

- **Activity**: Executive Report for NRA

KEY CHALLENGES & OPPORTUNITIES FOR THE NRA

Challenges:

•Predicting revenue accurately due to complex relationships between variables.

•Overfitting risks in predictive models.

•Identifying actionable insights from data to drive revenue growth.

Opportunities:

•Leveraging advanced models like Lasso Regression and GAM to improve revenue predictions.

•Identifying key revenue drivers to optimize restaurant operations.

•Using data-driven strategies to maximize revenue.

METHODOLOGY - MODELS USED

1. Lasso Regression:

1. Regularization technique to prevent overfitting.
2. Handles multicollinearity by shrinking less important coefficients to zero.

2. Generalized Additive Model (GAM):

1. Flexible model that captures non-linear relationships.
2. Provides interpretable partial spline functions for each feature.

- **Final Model Selection**:
- **GAM** is selected as the final model due to:
- Slightly better performance on training data (Train R^2: 0.9584 vs. 0.9581).
- Comparable performance on test data (Test R^2: 0.9549 vs. 0.9550).
- Ability to capture non-linear relationships, providing deeper insights into feature contributions.

FINAL MODEL SELECTION JUSTIFICATION

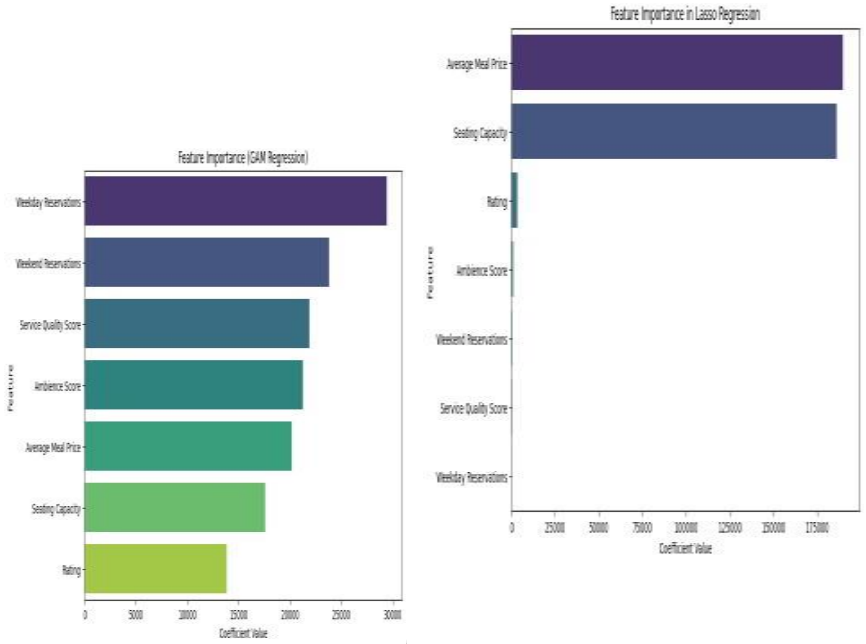
- **Generalized Additive Models (GAM)**:**Non-linearity**:
- Unlike linear regression, GAM captures non-linear relationships (e.g., diminishing returns from ratings).
- **Interpretability**: Visualizations like PDPs allow stakeholders to understand variable relationships intuitively.

- **Why GAM Over Other Models?**:
  - **Flexibility**: GAM handles multiple predictors with varying relationships to the target (revenue).
  - **Robustness**: Performs well even with complex and noisy data.

KEY REVENUE DRIVERS.

Evidence: • Partial Spline Function Graphs: Show that revenue increases with higher meal prices and service/ambience scores.

- **Feature Importance Graph: The Average Meal Price and Service Quality Score are significant contributors to revenue.**



- **Top 3 Variables**:

1.Average Meal Price:

1. Highest coefficient in Lasso Regression (189673.98).
2. Significant impact in GAM (Coefficient: 35187.68).
3. Directly influences revenue as higher prices lead to higher revenue pe customer.

2.Seating Capacity:

1. Second highest coefficient in Lasso Regression (186008.59).
2. Important in GAM (Coefficient: 29883.00).

3. More seats mean more customers, directly increasing revenue.

3.Ambience Score:

1. High coefficient in GAM (35845.58).
2. Reflects customer experience, which drives repeat visits and higher spending.

PARTIAL SPLINE FUNCTION ANALYSIS

Relationships Between Variables and Revenue:

1.Average Meal Price:

1. Positive linear relationship: Higher prices lead to higher revenue.

2.Seating Capacity:

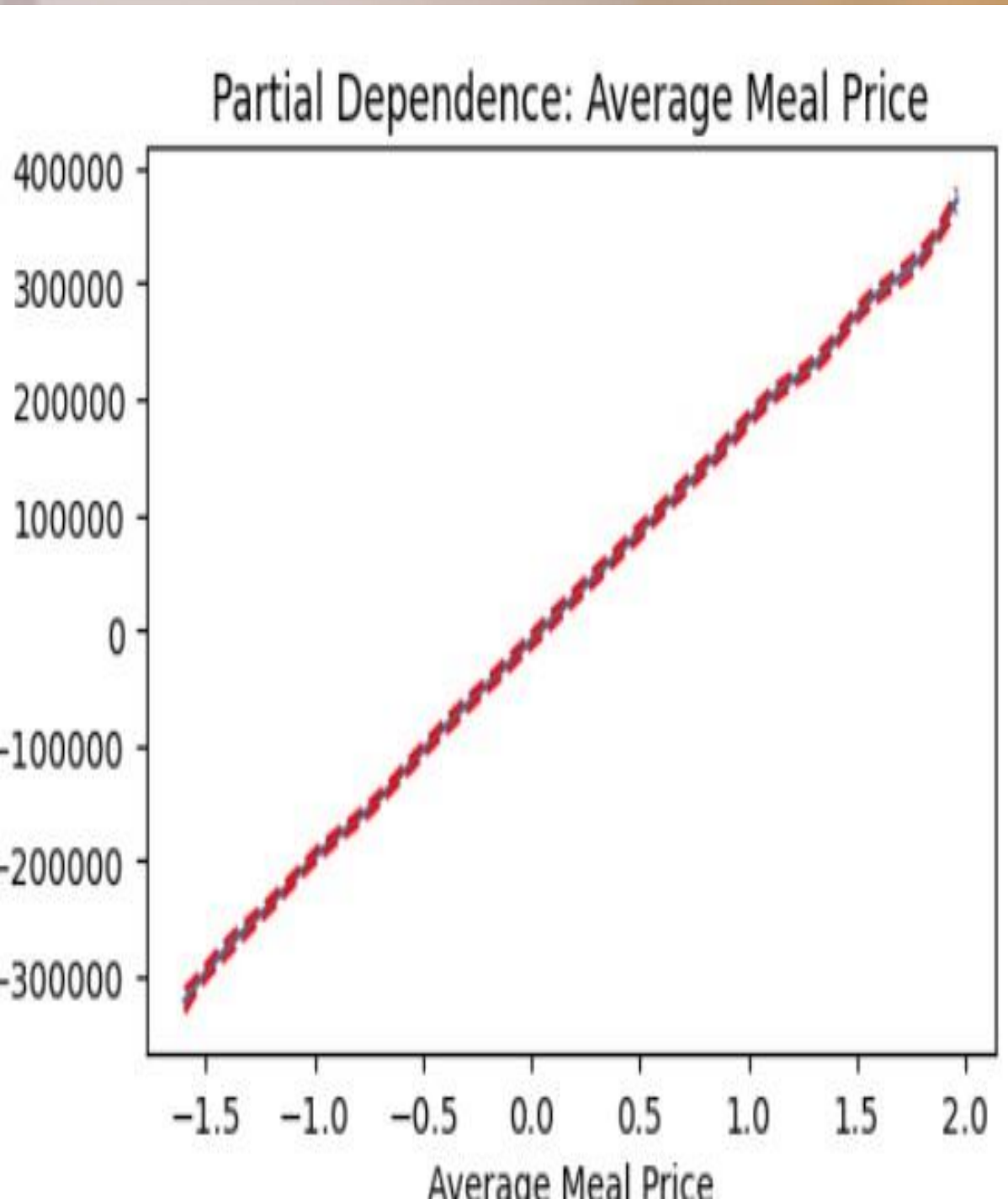
1. Positive linear relationship: More seats increase revenue potential.

3.Ambience Score:

1. Non-linear relationship: Revenue increases with better ambience but plateaus at higher scores.

4.Rating:

1. Optimal range between 3.0 and 4.5: Revenue peaks in this



BUSINESS STRATEGY 1 - OPTIMIZE PRICING STRATEGY

- **Strategy Name**: "Pricing for Profit"
- **Goal**: Adjust meal prices to maximize revenue without reducing customer base.
- **Implementation**:
  - Analyze customer segments and their price sensitivity.
  - Use dynamic pricing based on day of the week and time of year.
- **Expected Impact**: Increased revenue through optimized pricing that aligns with customer willingness to pay.

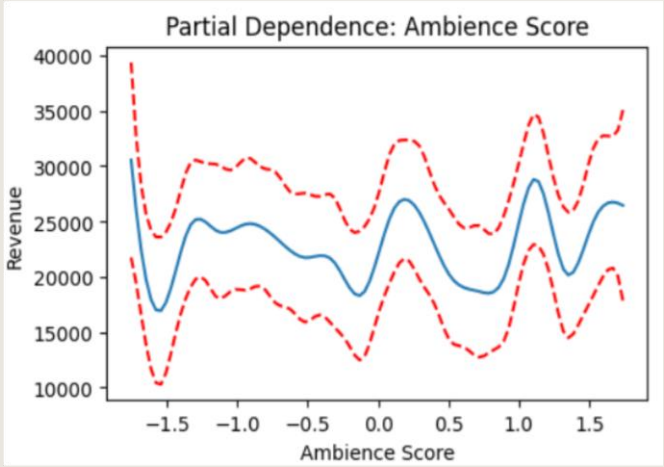
BUSINESS STRATEGY 2 - ENHANCE SERVICE AND AMBIENCE

- **Strategy Name**: "Customer Experience First“

- **Goal**: Invest in improving service quality and restaurant ambience to drive customer satisfaction and retention.

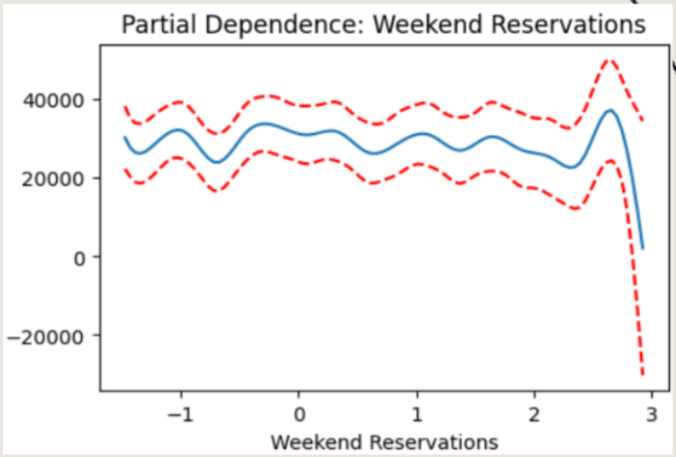
- **Implementation**:
  - Regularly train staff on service best practices.
  - Redesign restaurant layout or focus on decor improvements.

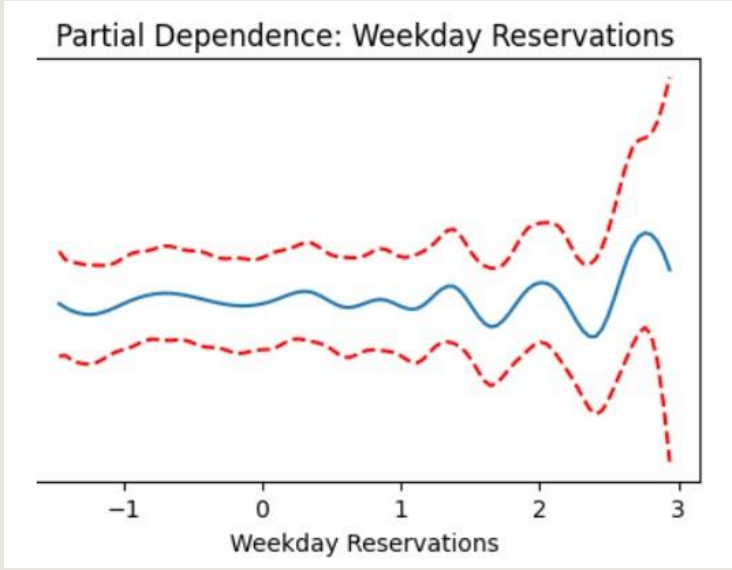
- **Expected Impact**: Higher customer ratings and repeat visits, leading to increased revenue.



BUSINESS STRATEGY 3 - OPTIMIZE RESERVATION SYSTEM

- **Strategy Name**: "Reservation Maximization"
- **Goal**: Improve reservation systems to maximize both weekday and weekend reservations.
- **Implementation**:
  - Offer promotions during slow hours (e.g., discounts for weekday reservations).
  - Enhance online reservation platforms for ease of booking.
- **Expected Impact**: Improved table occupancy and higher overall revenue.



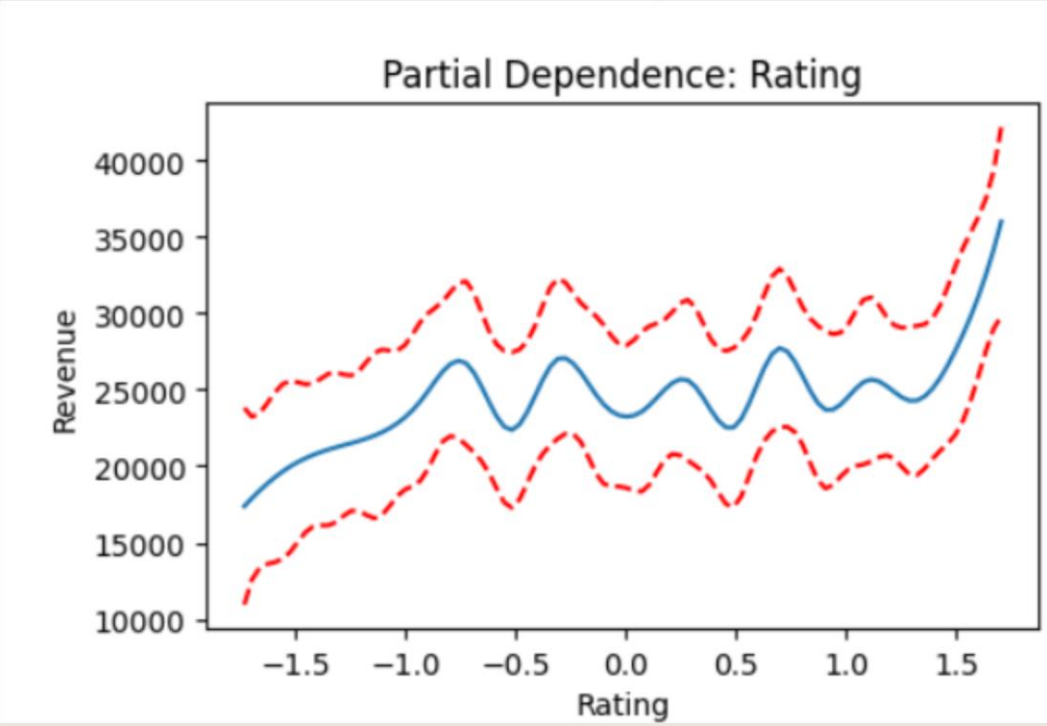


CHALLENGES & SOLUTIONS

- **Challenges**:
- Overfitting risk in models.
- Interpreting non-linear relationships in GAM.
- Balancing model complexity and interpretability.
- **Solutions**:
- Used regularization in Lasso Regression to reduce overfitting.

- Leveraged GAM’s partial spline functions to interpret non-linear relationships.
- Selected GAM as the final model for its balance of performance and interpretability.

RATING ANALYSIS



- **NRA's Belief**:
- Maintaining an average rating between 3.0 and 4.5 maximizes revenue.
- Perfect rating is unnecessary.
- **Findings**:
- Partial spline functions show revenue peaks in the 3.0–4.5 range.
- Beyond 4.5, revenue plateaus, supporting the NRA's belief.

CONCLUSION

- **GAM** is the best model for predicting revenue and identifying key drivers.
- **Top 3 Revenue Drivers**: Average Meal Price, Seating Capacity, Ambience Score.
- **Strategies**: Optimize pricing, expand seating, enhance ambience.
- **Rating**: Focus on maintaining ratings between 3.0 and 4.5 for maximum revenue.

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THANK YOU