Guided Capstone Project Report: Big Mountain Resort

1. Problem Statement

Big Mountain Resort is looking to determine the optimal ticket price for adult weekend passes based on market analysis of comparable resorts and to explore how facility modifications could impact their pricing power. The key objective is to identify a pricing strategy that would increase revenue while understanding the influence of resort features on pricing.

2. Data Wrangling

The data used for the analysis was collected from various ski resorts across multiple states. It included features such as ticket prices, vertical drop, number of fast quads, skiable terrain area, etc. The initial step involved cleaning the data, handling missing values using imputation (median and mean strategies), and filtering data to maintain consistency. Big Mountain Resort's data was excluded from model training to ensure unbiased pricing recommendations.

3. Exploratory Data Analysis (EDA)

Exploratory analysis revealed key insights regarding the relationship between features like vertical drop, snow-making acreage, and the number of fast quads, and their influence on ticket prices. Vertical drop, snow-making acreage, and chairlift types were identified as the most significant features driving price. During EDA, histograms, scatter plots, and feature importance charts were used to visualize the distribution and correlations.

4. Model Preprocessing with Feature Engineering

Data preprocessing involved splitting the data into training and testing sets, imputing missing values, and scaling features using StandardScaler. Feature engineering also included creating new features like ratios between total chairs and skiable terrain area. Key features were selected using `SelectKBest` with `f_regression` as the score function.

5. Algorithms Used to Build the Model and Evaluation Metrics

Two models were developed and evaluated:

1. **Linear Regression Model**: Built with imputation and scaling steps. It achieved an R^2 of 72% on the test set, indicating good performance but with signs of overfitting.
2. **Random Forest Model**: A more complex model, using multiple trees and hyperparameter tuning via `GridSearchCV`. It showed improved performance, with a cross-validated mean absolute error (MAE) of $9.7.

Evaluation Metrics:

- R^2 score was used to measure variance explained by the models.

- Mean Absolute Error (MAE) provided insight into the accuracy of the price prediction.

6. Winning Model and Scenario Modeling

The **Random Forest Model** was selected as the winning model due to its lower MAE and greater consistency in performance on unseen data.

Scenario Modeling: Several scenarios were explored to understand the impact of facility changes on ticket price:

1. **Closing Runs**: The model indicated that closing up to 3 runs had minimal impact, while more led to a significant price decrease.
2. **Adding a Chair Lift and Extending Vertical Drop**: Adding a run and extending the vertical drop increased price support by $0.60.
3. **Adding Snow-making Acres**: Small increases in snow-making area had minimal impact on price.
4. **Extending Longest Run**: Extending the longest run by 0.2 miles did not impact the ticket price significantly.

7. Pricing Recommendation

The model suggests that Big Mountain Resort could set its ticket price at **$95.87** instead of the current **$81**, based on the facilities they offer and market pricing trends. This would align the pricing more closely with comparable resorts with similar features. The recommendation is to proceed cautiously, perhaps with a phased increase, considering customer sensitivity.

8. Conclusion

Big Mountain Resort appears to be undercharging relative to the market potential for its facilities. The analysis suggests a price increase could be justified, and adding infrastructure like chair lifts might also increase pricing power. The Random Forest Model provided the most reliable predictions and formed the basis of these recommendations.

9. Future Scope of Work

Future work could involve gathering additional data such as operational costs, visitor satisfaction scores, or occupancy rates, which would provide deeper insights into the appropriate price point. Additionally, testing small incremental price increases and gathering customer feedback could further validate the proposed strategy.