Big Mountain Resort Pricing Analysis

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Introduction

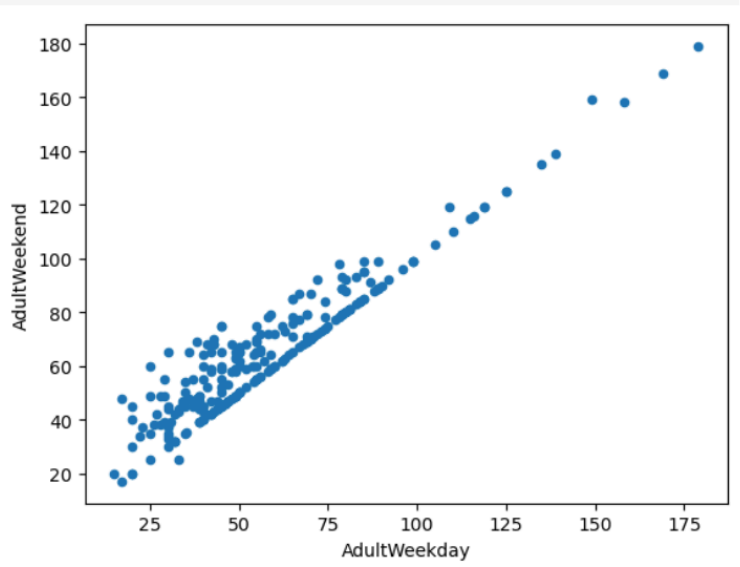
Big Mountain Resort is a ski resort located in Whitefish, Montana that can accommodate skiers and riders of all levels and abilities. Every year about 350,000 people ski or snowboard at Big Mountain. These are serviced by 11 lifts, 2 T-bars, and 1 magic carpet for novice skiers. The longest run is 3.3 miles in length, the base elevation is 4,464 ft, and the summit is 6,817 ft with a vertical drop of 2,353 ft. They recently installed an additional chair lift to help increase the distribution of visitors across the mountain, which increases their operating costs by $1,540,000 this season. They are looking for guidance on how to select a better value for their ticket price to increase overall revenue, and how to cut expenses to help recoup the increased operating costs from the new chair.

Problem Statement

Big Mountain Resort is looking to increase overall profits by optimizing its ticket pricing strategy by increasing ticket prices, increasing the number of days/hours open, and/or reducing the number of runs or total skiable area to reduce operation costs for the upcoming ski season. Leveraging data from ski resorts nationwide, how can we establish a pricing strategy that balances market competitiveness with an accurate reflection of Big Mountain Resort's amenity value?

Data Wrangling

Our data captures key metrics for various ski resorts across the country, including vertical drop, lift quantity, and run count, along with their weekday and weekend pricing structures. Initially, we focused on comparing adult weekend and weekday prices to determine if a weekend premium exists. Interestingly, the data revealed that some States show a marked difference between weekday and weekend ticket prices, but the below graph reveals that there is a clear line where weekend and weekday prices are equal.

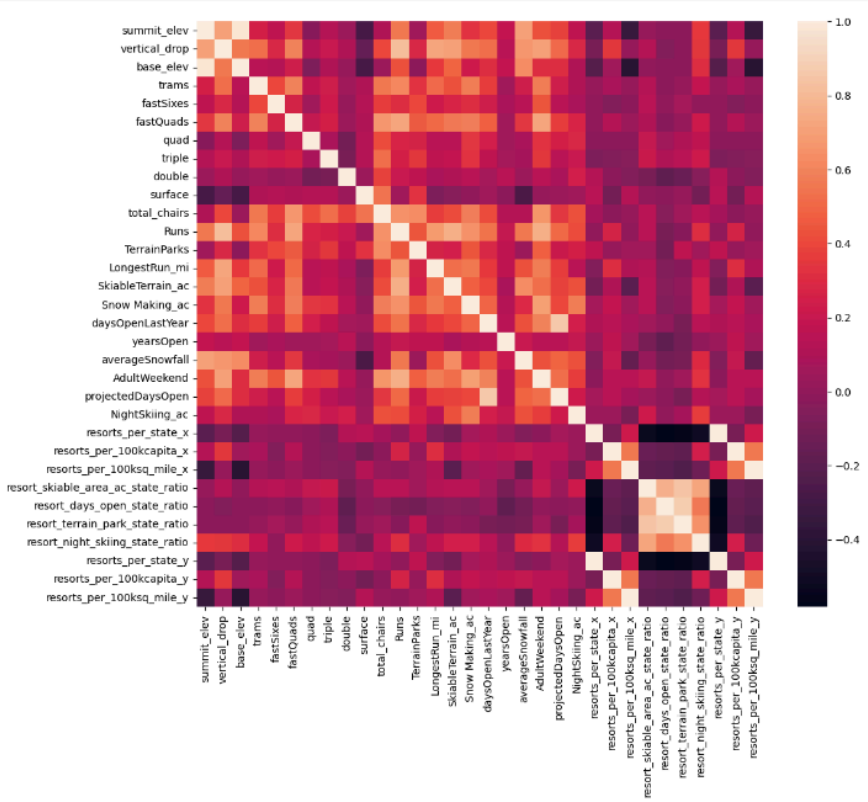


Weekend prices have the least missing values of the two, so AdultWeekday prices were dropped. We dropped all rows with no pricing information since pricing is our target. The fastEight column was also dropped because half the values were missing and all but the others are the value zero. Other smaller columns had to be dropped as well.

Exploratory Data Analysis

Our goal was to uncover trends and patterns within the data that could provide actionable insights for Big Mountain Resort. We began by examining the relationship between total resort counts and population or area density. While this exploration didn't yield directly applicable information, it helped refine our focus. Next, we investigated the connection between price and various features like vertical drop, years of operation, and skiable acreage across different states. Principal Component Analysis revealed that the first two principal components seem to account for 75% of the data's variance, and the first four accounted for over 95%. To visualize the relationship between price and the most significant components (the first two based on PCA), we scaled the data and plotted it along with the average ticket price. However, a scatter plot didn't provide a clear enough picture.

To gain a clearer understanding of the relationships between features, we created a heatmap. This visualization highlighted a strong positive correlation between "AdultWeekend" ticket prices and features like fastQuads, number of Runs, SnowMaking_Ac (presence of artificial snowmaking), and resort_night_skiing_state_ratio. Of the new features, resort_night_skiing_state_ratio seems the most correlated with ticket price.



These insights into the features most correlated with weekend adult ticket prices provide a valuable foundation for building a data-driven model that can determine more accurate ticket pricing strategies for Big Mountain Resort.

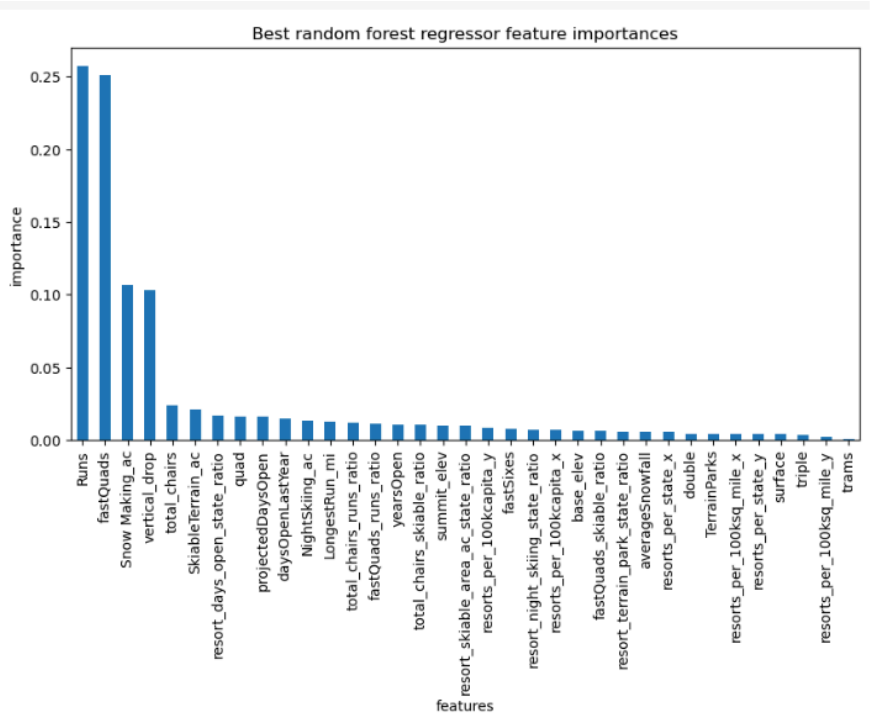
Model Preprocessing

Our initial approach involved taking the average price across the four categories most correlated with ticket costs. This "best estimate" baseline price was $63.81. However, the mean absolute error (MAE) of this value was significant - around $19.14, which is unacceptable for ticket prices in this range.

To refine our approach, we explored median-based regression. This reduced the MAE to around $9, indicating an improvement. To ensure consistent results for further comparisons, we built a data pipeline to automate data processing steps.

Next, we implemented a Random Forest Regression model. This analysis revealed that imputing missing values with the mean for our initial four features improved the model's MAE. Additionally, we discovered that vertical drop also significantly influences ticket pricing. When incorporated into the Random Forest model, this new feature resulted in a lower cross-validation MAE by almost $1 and exhibited less overall variability.

This iterative process of exploration, analysis, and model building demonstrates a clear improvement in our ability to predict ticket prices for Big Mountain Resort.



Winning Model and Scenario Modeling

Through hyperparameter search with GridSearchCV, we've identified the top 8 features most influential in predicting ticket prices. These features include:

- Ski Lift Infrastructure: fastQuads, total_chairs, trams
- Terrain: number of Runs, LongestRun_mi, vertical_drop
- Amenities: SnowMaking_Ac, resort_night_skiing_state_ratio

Our Random Forest Regression model has emerged as the best predictor for Big Mountain Resort. Leveraging these insights, we can now use this data-driven model that recommends a ticket price based on these key factors. To determine an appropriate pricing strategy for Big Mountain, the next step involves analyzing its position within each of the above identified categories.

Pricing recommendation

Big Mountain Resort's actual price is $81.00, and our modeling suggests an increase in ticket price to $96.78 that could be supported in the marketplace with their current facilities. Even with the expected MAE of $10.32, this suggests there is room for an increase. The additional operating cost of the new chair lift, approximately $1,540,000 should be taken into consideration when establishing a new price. We recommend an increase in

ticket price of $5 per ticket. Using an estimate of 350,000 visitors per year with an average 5 day stay, revenue can be increased by approximately $8,750,000, which allows plenty of room to fund for the new chair lift and other continued investments.

More considerations we reviewed included adding 2 acres of snow-making, which does not appear to make a noteable difference. Lastly, Big Mountain should consider closing up to a total of 5 runs as the model suggests this number will only lead to a slight price decrease. They should not close more than 5 runs, or they run the risk of a much larger drop in price.

Conclusion

This analysis has laid the groundwork for a data-driven approach to ticket pricing at Big Mountain Resort. We've identified key features influencing price through exploration and Random Forest Regression. While the model suggests a potentially higher price than current practices, collaborating with business leaders is crucial to understand their existing strategies and uncover any missing factors impacting pricing decisions.

The model's value extends beyond price recommendations. It can be used by business analysts to explore various scenarios and identify optimization opportunities. We can further enhance its accessibility for business users by developing a user interface and providing training. This ensures the model becomes a valuable tool for informed decision-making.

However, the work doesn't stop here. Addressing data limitations, investigating price discrepancies, and constantly updating the model with new data are essential for sustained growth. By following this data-driven path, Big Mountain Resort can continuously refine its pricing strategy and optimize its offerings to remain competitive and achieve long-term success.