Big Mountain Resort Pricing Model

Background:

Big Mountain Resort (BMR), a ski resort located in Montana, offers spectacular views of Glacier National Park and Flathead National Forest. Every year about 350,000 people ski or snowboard at Big Mountain. The resort offers a vertical drop of 2353 feet, 105 runs serviced by 14 chair lifts including 3 fast quads and 600 acres of snowmaking to ensure snow cover.

Big Mountain Resort recently implemented a new chair lift to increase distribution of visitors across the mountain. To stay profitable BMR must offset the additional $1.5M/season operating cost for the lift through cost savings or increased revenue. Historically, BMR has charged a premium for its lift tickets compared to the average price of resorts in its market segment without fully understanding which aspect of their facilities provide the most value to customers. BMR would like to adopt a data driven business strategy allowing them to rationalize higher ticket prices, strategically invest in facilities, and maximize their profitability.

Problem Statement:

How can Big Mountain Resort restructure their ticket pricing model to offset their new (and ongoing) $1.54M lift operating cost by understanding and maximizing their facility investment strategy before the start of next ski season?

Data & Problem Approach:

The dataset provided for analysis contained information for 330 ski resorts in 35 states (US only) detailing the features[1] offered by each resort as well as their pricing model. To provide a pricing strategy for Big Mountain the features were modeled for all other resorts using several machine learning techniques to predict current ticket price. The models identified which features have the greatest predictive value on price signaling which features customers are willing to pay for. One key assumption for this analysis is that the resorts included in the dataset are using pricing models based on how much customer value certain facilities or to put it more plainly that the free market is truly dictating prices.

Additionally, Big Mountain Resort has provided several potential scenarios for either cutting costs or increasing revenue that were analyzed to determine the overall business impact.

1. Permanently closing up to 10 of the least used runs. This does not impact any other resort statistics.
2. Increase the vertical drop by adding a run to a point 150 feet lower down but requiring the installation of an additional chair lift to bring skiers back up, without additional snow making coverage
3. Same as number 2, but adding 2 acres of snow making cover
4. Increase the longest run by 0.2 mile to boast 3.5 miles length, requiring an additional snow making coverage of 4 acres

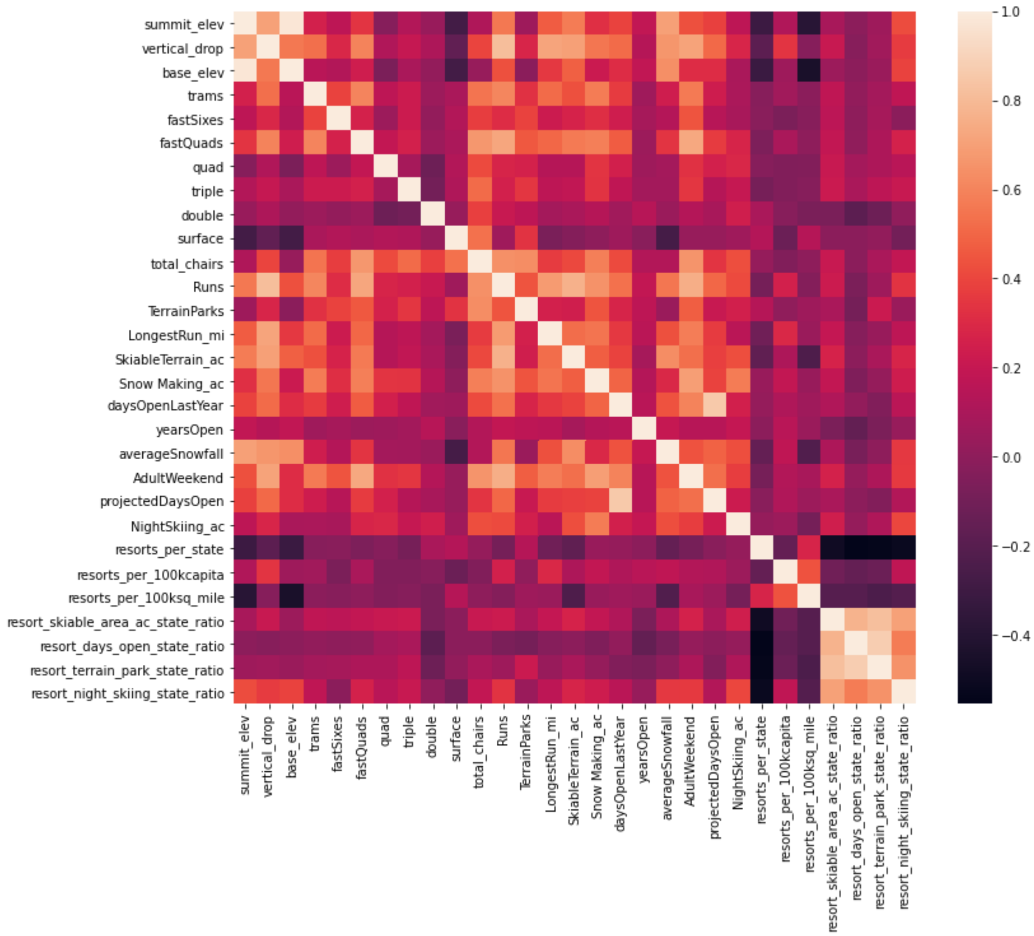
Feature Analysis

To get an overview on the relationship between price and the various features offered at resorts a heatmap of their correlations can be seen in figure 1 below. The key signals from the heatmap indicated:

- Having more vertical drop available on the mountain allows for higher ticket prices
    - Customers value steep and/or long runs
- More runs correlated with a higher ticket price
    - Customers are willing to pay more for a higher number of unique runs and this seems to matter more than just the amount of skiable area
- Fast quads and similarly more chairs correlated with a higher ticket price
    - Customers appear to value when more chairs are available meaning less waiting. Similarly, fast quads are highly valued because they allow a high volume of skiers to move around the mountain quickly
- Resorts with snow making equipment were also able to charge higher prices
    - Customers are willing to pay for guaranteed snow coverage

Similar features were identified by the various modeling techniques throughout the analysis indicating that these would be the initial categories to focus on to maximize value to customers.

FIGURE 1: FEATURE CORRELATION HEATMAP



Modeling

Several models were built by partitioning the data into a 70/30 train/test randomized split. The models were structured to predict the price of a lift ticket utilizing the features offered by the resorts.

Baseline Model

Utilizing the mean ticket price of the train dataset ($63) as a baseline, allowed comparison to ensure that any future model was better than guessing the average. The mean absolute error for this model was $19.13.

Linear Model

The linear model used the median value to replace any missing values, selected 8 features[2] as the ideal number to include in the model, scaled the features using normalization and used 5-fold cross validation. The model improved upon the baseline with a mean absolute error of $11.79.

Random Forest Model

The last model tested was a random forest iteration that utilized 69 trees, the median for correcting missing values, 5-fold cross validation and no scaling. This model proved to best describe the dataset with a mean absolute error of $9.52. The dominant features in this model were fast quads, runs, snow making area, and vertical drop.

Findings

Based on the key features that customers were willing to pay for Big Mountain seems well-positioned in the market. Big Mountain resort is currently charging $81 for a lift ticket. The model predicts a price of $95.88. This still allows for an increase even with the model's mean absolute error of $10.36. For quick comparison BMR ranks in the 80th percentile for ticket price but at least the 90th percentile for all key features.

FIGURE 2: TICKET PRICE DISTRIBUTION

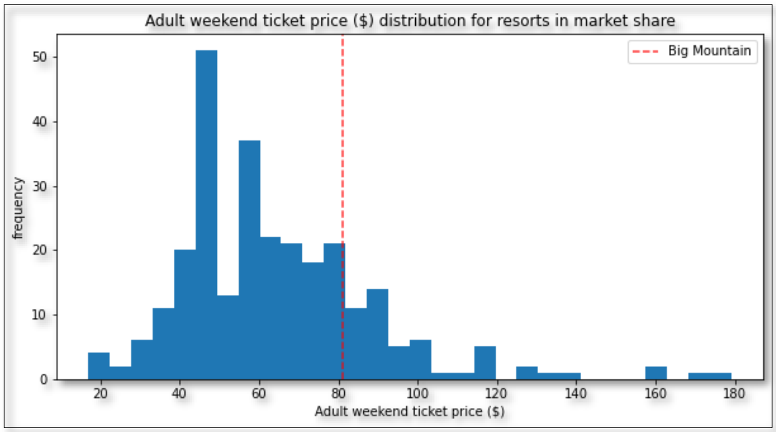
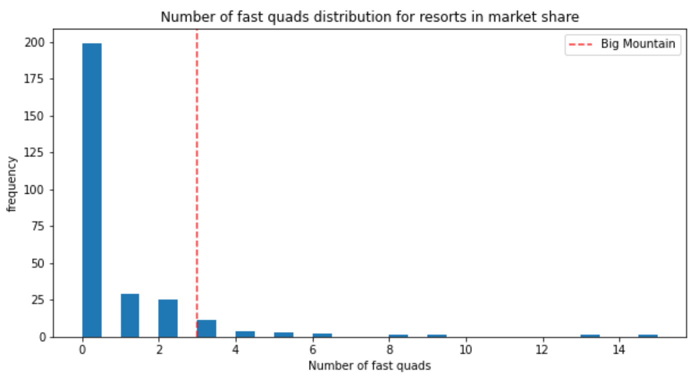
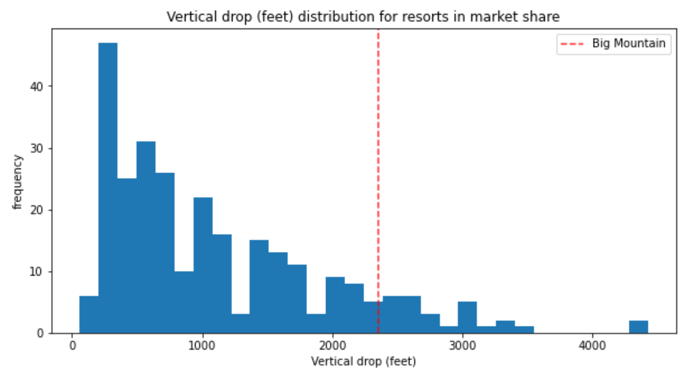


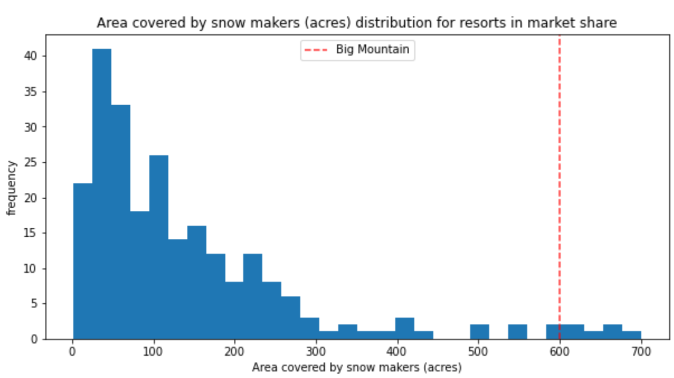
FIGURE 3: KEY FEATURES AT A SKI RESORT: FAST QUADS, VERTICAL DROP, SNOW MAKING AREA, TOTAL RUNS



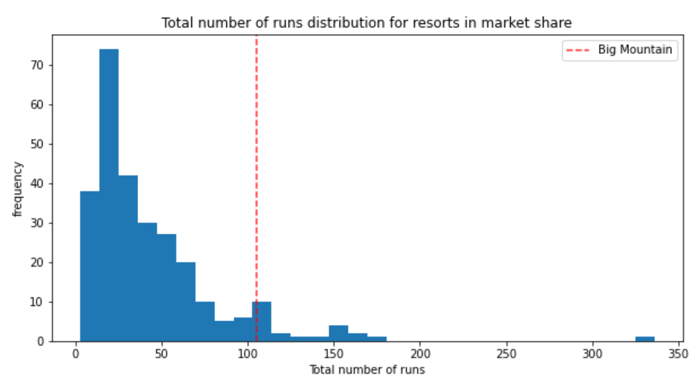
Big Mountain Resort has a more fast quads than 95% of resorts.



Big Mountain Resort has a bigger vertical drop than 90% of resorts.



Big Mountain has more snow making coverage than 97% of resorts.



Big Mountain Resort has more runs than 93% of resorts.

Recommendations

Based on the predicted price from our model, the known error, and the assumptions made about how ticket prices are set at other resorts, Big Mountain should be conservative and increase the daily ticket price to $85 next season regardless of any other changes. Based on how the market responds additional increases can be considered in the following seasons.

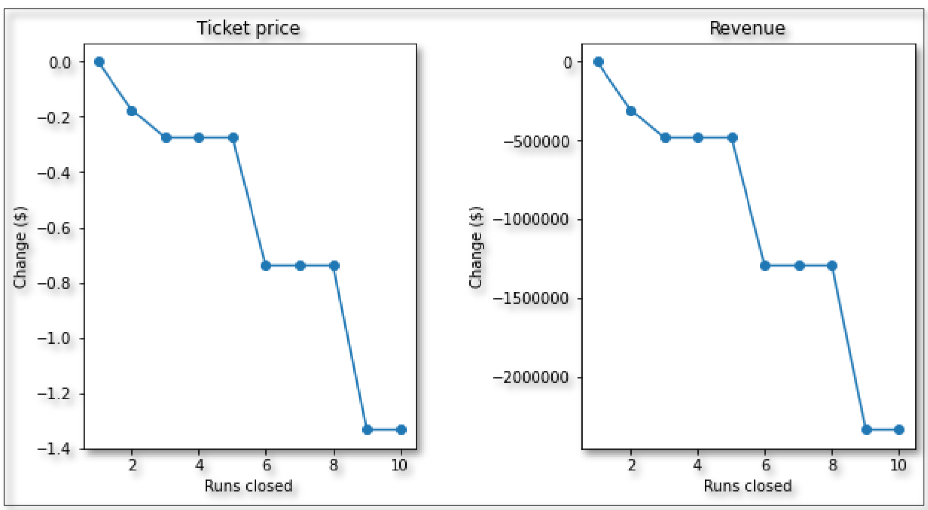
One of the original factors driving this analysis was that the Big Mountain recently added a chair lift that would increase its operating cost by $1.54M/year. To offset this cost Big Mountain will need to increase their daily ticket price by at least $1.14 which is easily covered by increasing the ticket price to a fair market value price of $85.

Of the other improvements or cost-savings measures that were considered Big Mountain should move forward with closing down at least one of the least used runs and consider increasing their vertical drop with the addition of another chair lift.

Run Closure

A reasonable strategy for closing less used runs would be to start with closing 1-2 runs. This will have a minimal impact on the ticket price. Depending on other pricing decisions, 3 additional runs could be closed resulting in about $500K decrease in revenue. This could make business sense depending on the reduced operating costs associated with closing each run. To test start with 2 closures and assess customer reaction before shutting down the additional 3 runs. No more runs than 5 runs should be closed due to the significant impact on customer perception, ticket price, and overall revenue.

FIGURE 4: EFFECT OF RUN CLOSURES



Vertical Drop

The vertical drop addition should be considered if the price for the additional chair lift is comparable to the most recent lift added ($1.54M). Tickets could be increased by $1.60 bringing a daily ticket to $86.60. The additional $2.8M in revenue will offset the additional operating cost for the lift.

Other Suggested Improvements

The remaining scenarios did not have any significant impact on the model predicting a higher ticket price. These scenarios should not be considered any further.

Dataset Included Features[1]

Column	Description
Name	The name of the ski resort.
Region	The region within the United States where the resort is located.
state	The state name where the resort is located.
summit_elev	Elevation in feet of the summit mountain at the resort.
vertical_drop	Vertical change in elevation from the summit to the base in feet.
base_elev	Elevation in feet at the base of the resort.
trams	The number of trams.
fastEight	The number of fast eight person chairs.
fastSixes	The number of fast six person chairs.
fastQuads	The number of fast four person chairs.
quad	Count of regular speed four person chairlifts.
triple	Count of regular speed three person chairlifts.
double	Count of regular speed two person chairlifts.
surface	Count of regular speed single person chairlifts.
total_chairs	Sum of all the chairlifts at the resort.
Runs	Count of the number of runs on the resort.
TerrainParks	Count of the number of terrain parks at the resort.
LongestRun_mi	Length of the longest run in the resort in miles.
SkiableTerrain_ac	Total skiable area in square acres.
Snow Making_ac	Total area covered by snow making machines in acres.
daysOpenLastYear	Total number of days open last year.
yearsOpen	Total number of years the resort has been open.
averageSnowfall	Average annual snowfall at the resort in inches.
AdultWeekday	Cost of an adult weekday chairlift ticket.
AdultWeekend	Cost of an adult weekend chairlift ticket.
projectedDaysOpen	Projected days open in the upcoming season.
NightSkiing_ac	Total skiable area covered in lights for night skiing.

Linear Regression Model Features Selected[2]

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vertical_drop        10.767857
Snow Making_ac        6.290074
total_chairs          5.794156
fastQuads             5.745626
Runs                  5.370555
LongestRun_mi         0.181814
trams                -4.142024
SkiableTerrain_ac    -5.249780
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