# Guided Capstone Project

## Problem Statement:

What opportunities exist for Big Mountain Resort to implement a new pricing strategy that can improve the capitalization of its facilities investments to offset their recent additional operating cost by $1,540,000 this season.
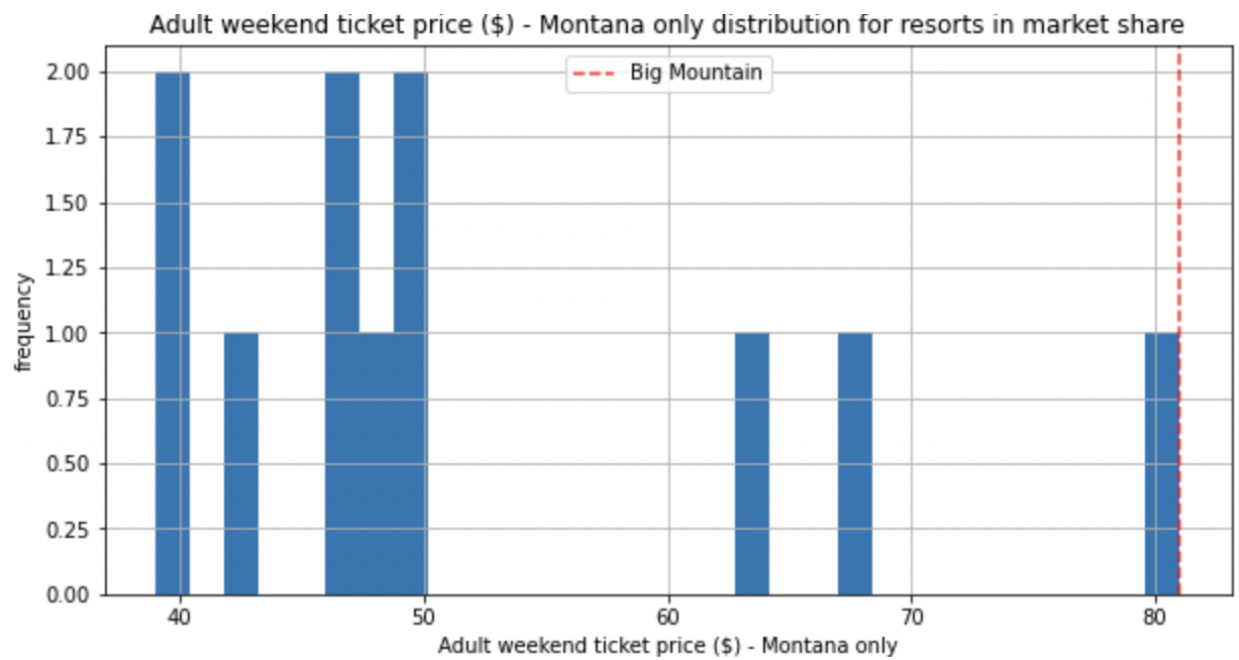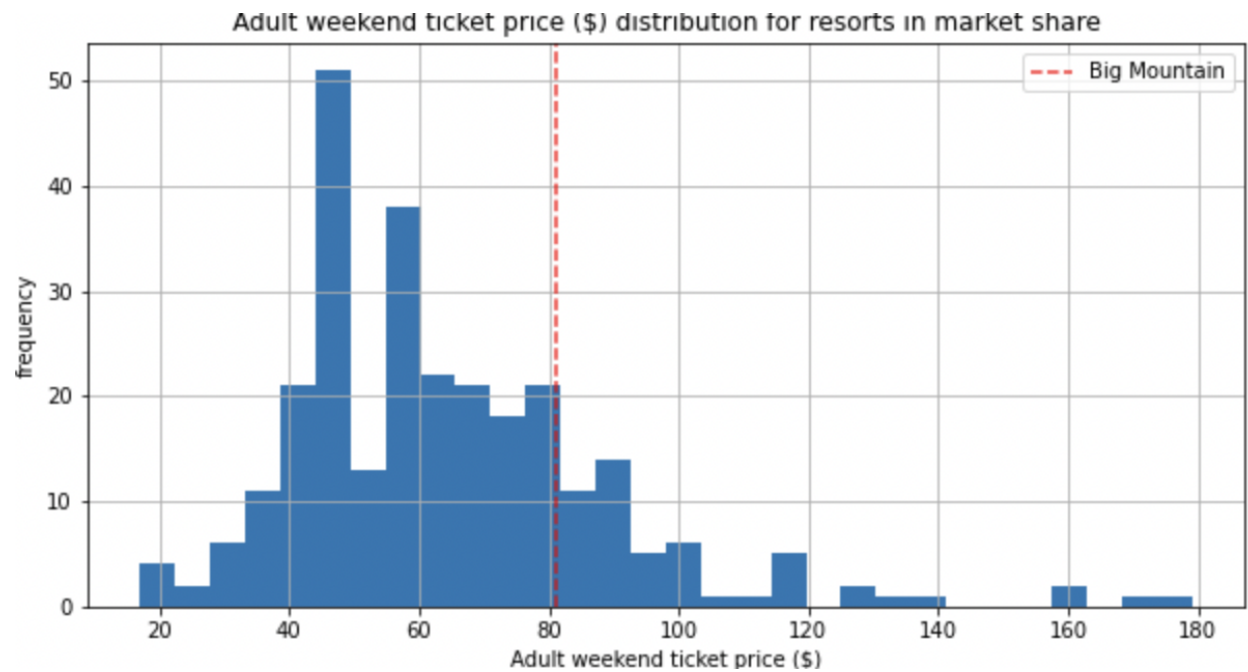
## Resort Story:

Big Mountain Resort offers spectacular views of Glacier National Park and Flathead National Forest, with access to 105 trails. Every year about 350,000 people ski or snowboard at Big Mountain. The business has expressed a desire for some guidance on how to select a better value for their ticket price.  Their hope in considering these changes is to either cut costs without undermining the ticket price, or to have a reasoning in support of an  even higher ticket price.

## Current Pricing Strategy:

The resort's pricing strategy has been to charge a premium above the average price of resorts in its market segment.

For Big Mountain Resort to base their pricing mainly on just the market average won't be enough to maximize their capitalization investment and can't be sustainable to gain an edge over the competition.

Adult weekend ticket price ($) distribution for resorts in market share



Adult weekend ticket price ($) - Montana only distribution for resorts in market share

# Modeling scenarios:

Big Mountain Resort has been reviewing potential scenarios for either cutting costs or increasing revenue (from ticket prices). Ticket price is not determined by any set of parameters; the resort is free to set whatever price it likes. However, the resort operates within a market where people pay more for certain facilities, and less for others. Being able to sense how facilities support a given ticket price is valuable business intelligence. This is where the utility of our model comes in.

The business has shortlisted some options:

- Permanently closing down up to 10 of the least used runs. This doesn't impact any other resort statistics.
- 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
- Same as number 2, but adding 2 acres of snow making cover
- Increase the longest run by 0.2 mile to boast 3.5 miles length, requiring an additional snow making coverage of 4 acres

The expected number of visitors over the season is 350,000 and, on average, visitors ski for five days. Assume the provided data includes the additional lift that Big Mountain recently installed.

# Feature Engineering:

- A great way to gain a high level view and identify patterns of relationships amongst the features is to use the Feature Correlation heatmap as shown below:



Correlations in ski_data
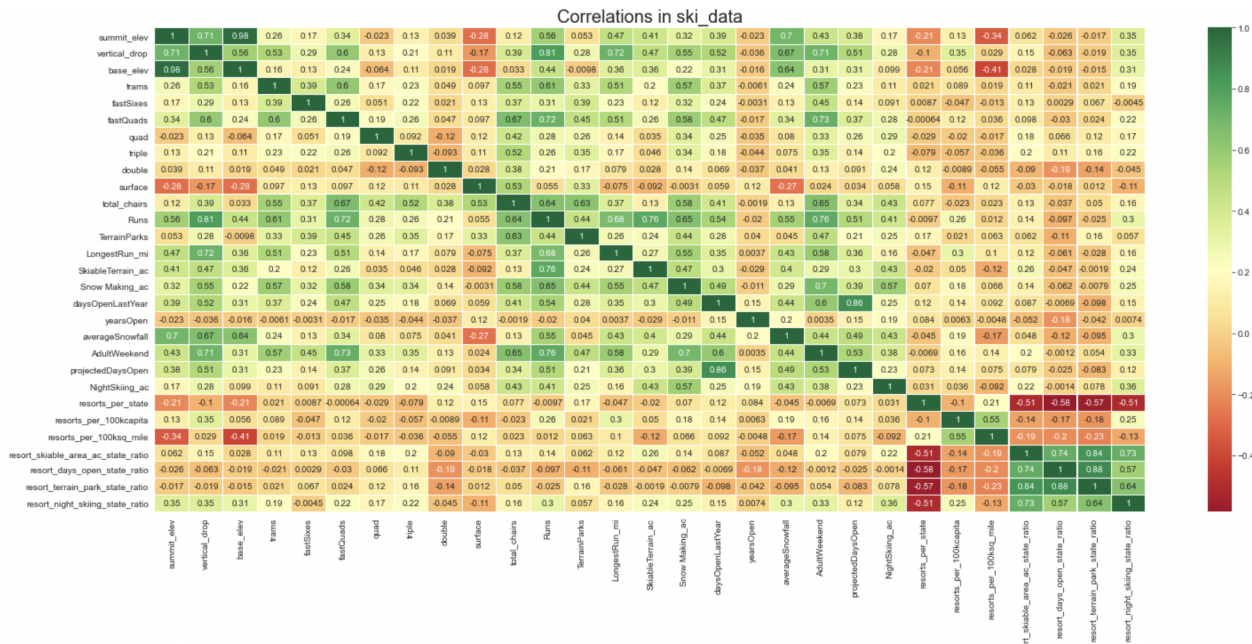
We can immediately see some feature relationships.

- Summit and base elevation are quite highly correlated.
- We see quite a few reasonable correlations for AdultWeekend ticket price. Among them fastQuads stands out, along with Runs and Snow Making_ac.
- Another interesting fact we can infer is that visitors seem to value more guaranteed snow, this would cost in terms of snow making equipment, that would drive prices and costs up.
- Also, Runs, total_chairs are quite well correlated with ticket price. It is plausible that the more runs you have, the more chairs you'd need to ferry people to them. Interestingly, they may count for more than the total skiable terrain area.
- The total skiable terrain area is not as useful as the area with snow making. People seem to put more value in guaranteed snow cover rather than more variable terrain areas.

Feature Correlation Scatter Plots:

Correlations, particularly viewing them together as a heatmap, can be a great first pass at identifying patterns. But correlation can mask relationships between two variables. The following scatterplots show how ticket price varies with other numeric features.

- There's a strong positive correlation with vertical_drop.
- fastQuads seems very useful. Runs and total_chairs appear quite similar and also useful.
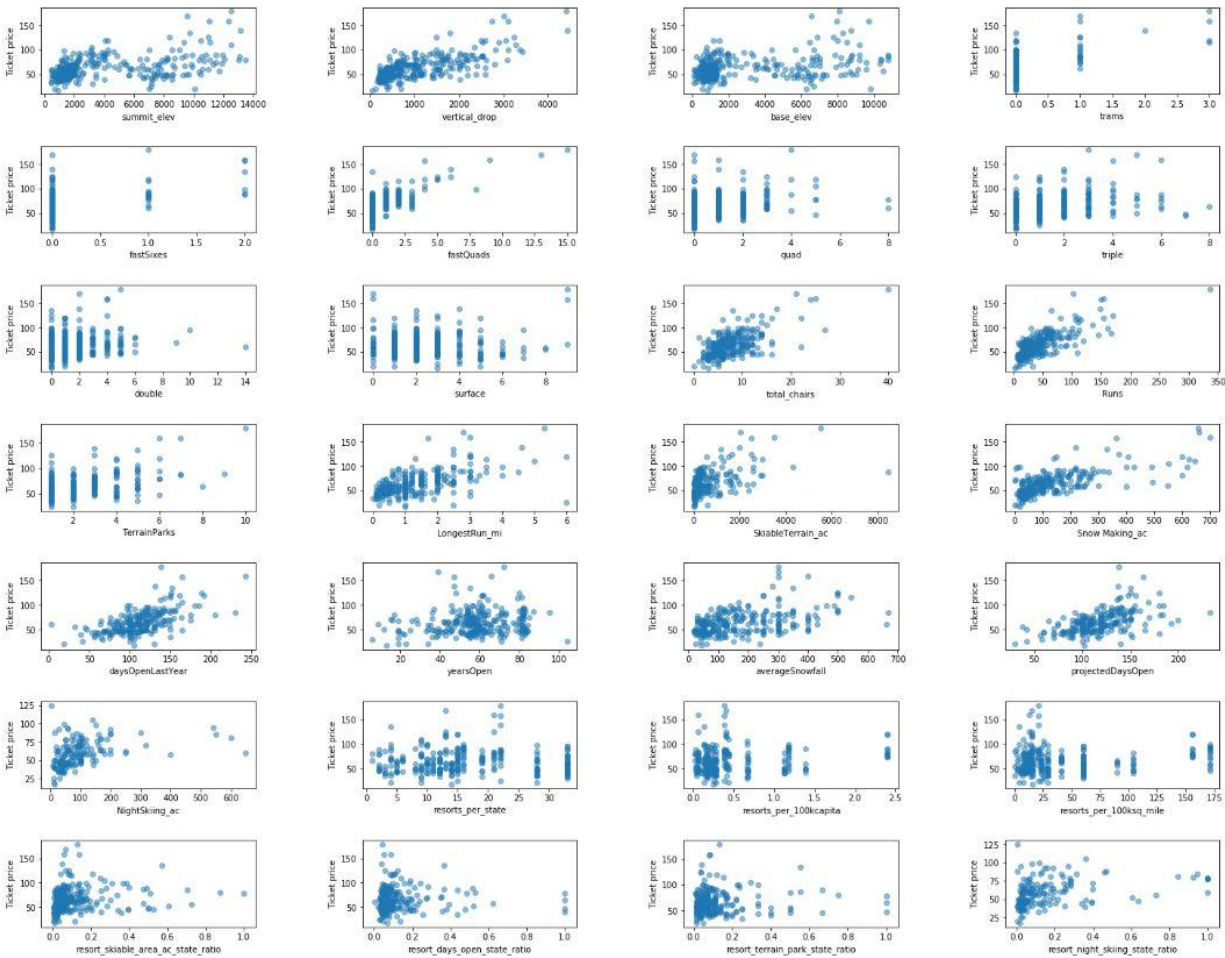
# Pre-Processing and Training Data:

- Linear Model: In the process of building the linear model, missing values were imputed with the median and mean values. If ticket prices were predicted using the linear model, they would be off by about $9. However, the initial linear model was overfitting and needed to be adjusted by the number of features. Through cross-validation, the value of k was set to eight features to focus on: vertical_drop, Snow Making_ac, total_chairs, fastQuads, Runs, LongestRun_mi, trams, and SkiableTerrain_ac. These features fit our initial assumptions from EDA.
- Random Forest Model: Was developed. Like the linear model, missing values were imputed with the median and mean values. While imputing the median was helpful, it was not helpful to scale the features. The random forest model revealed that the top four features to consider are fastQuads, Runs, Snow Making_ac, and vertical_drop.
- Final Model Selection: After testing both the linear model and random forest model, the project decided to move forward with the forest regression model. Comparison of the two demonstrated that performance on the test set was consistent cross-validation results. Additionally, the cross-validation mean absolute error was lower using the random forest regressor.

# Recommendations:

- Our Model suggests that Mountain Resort's ticket price is lower than the predicted model by 16.31%, and the resort has many potential scenarios for either cutting costs (by closing runs) or increasing ticket price (by increasing vertical drop, adding acres of snow making or increasing the longest run).
- Our model suggests that closing one run makes no difference. Closing 2 and 3 successively reduces support for ticket price and so revenue, while this will also result in reducing the resort's operating cost. If Big Mountain closes down 3 runs, it seems they may as well close down 4 or 5 as there's no further loss in ticket price. Only, when we Increase the closures down to 6 or more, it leads to a large drop in revenue.

Ticket price

Revenue

Total number of runs distribution for resorts in market share
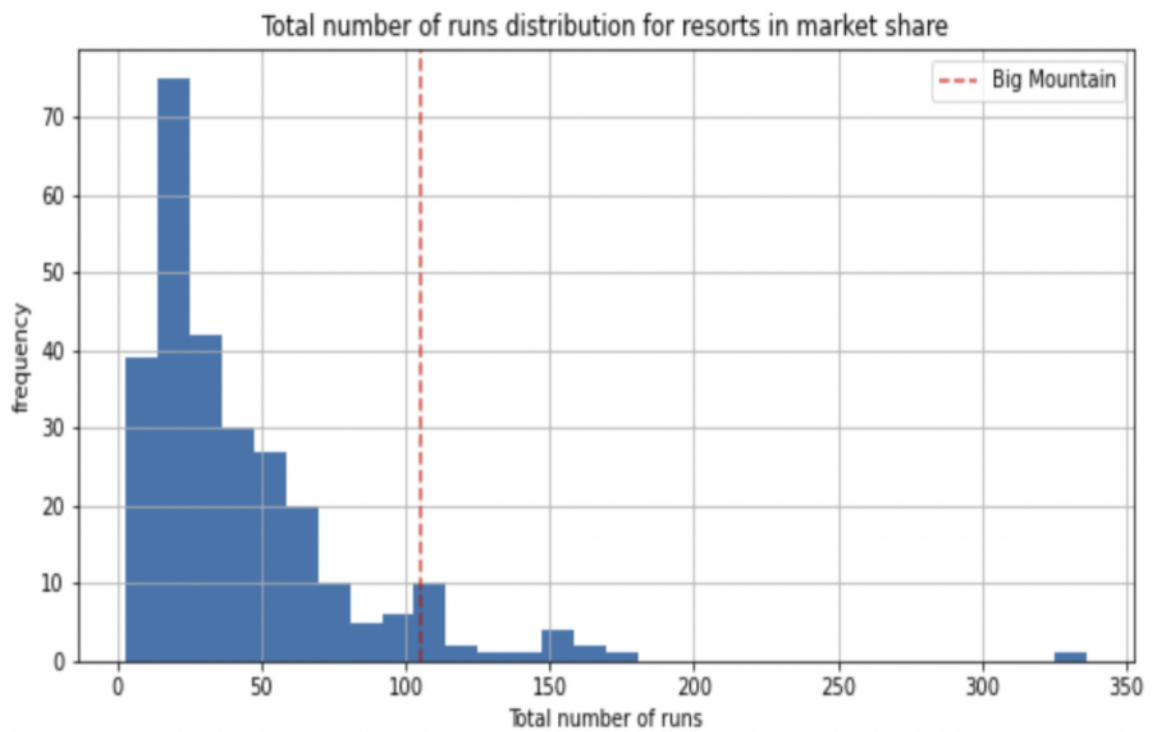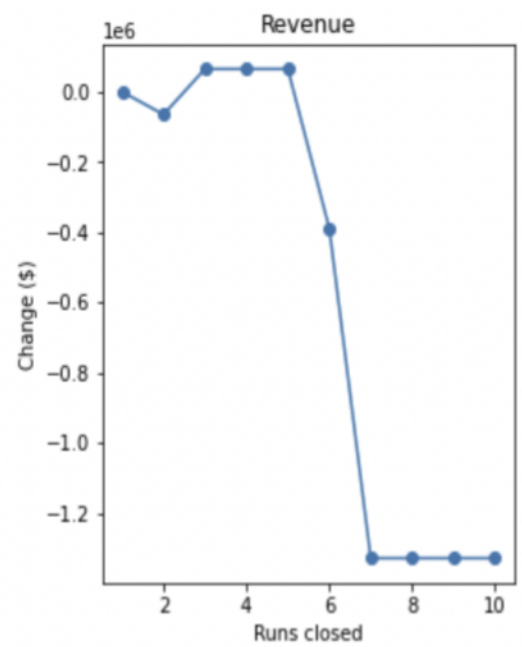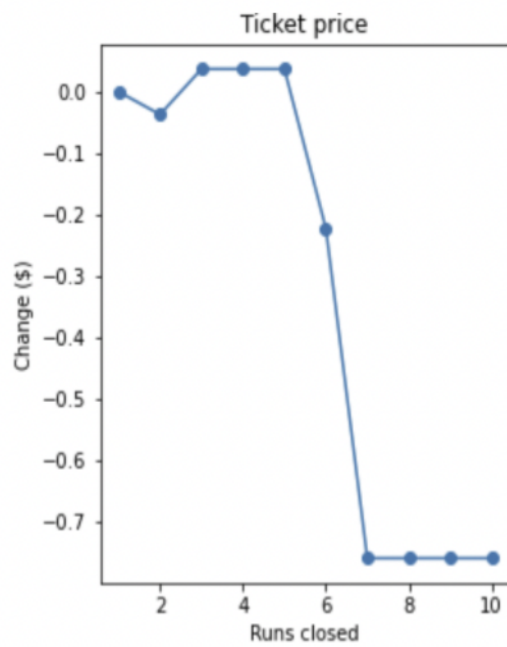
- Big Mountain adds a run, increases the vertical drop by 150 feet, and installs an additional chair lift.
- Increasing the vertical drop by 150 feets will increase the Ticket Price by 17.04 USD, resulting in revenue increase by 5,964,000 US Dollars. But, this would also result in additional cost of adding a new chair lift (Operating Cost $1,540,000 for this season) also we need an additional run (Cost is Not given)

# Conclusion:

After applying our Model for ski resort ticket price and leverage it to explore Big Mountain Resort's potential scenarios for increasing revenue, we can conclude that:

- The best scenario where we managed to gain the highest revenue increase possible was by increasing the vertical drop by 150 ft, adding one Chair Lift, adding one run and adding 2 acres of snow making cover.
- Due to lack of data in regards to operating cost per used run and weekdays ticket price, our model cannot recommend closing down used runs or implementing dynamic ticket pricing.

## POTENTIAL SCENARIOS FOR INCREASING REVENUE



Chart — Ticket Price vs Features:
- Increase Longest run by 0.2 mi (Requires adding 4 acres of snow making coverage): 81
- Increase vertical drop by 150Ft. Plus add one chair lift and one run.: 98.04
- Increase vertical drop by 150Ft. Plus add one chair lift and one run. Add 2 acres of snow making cover: 98.69