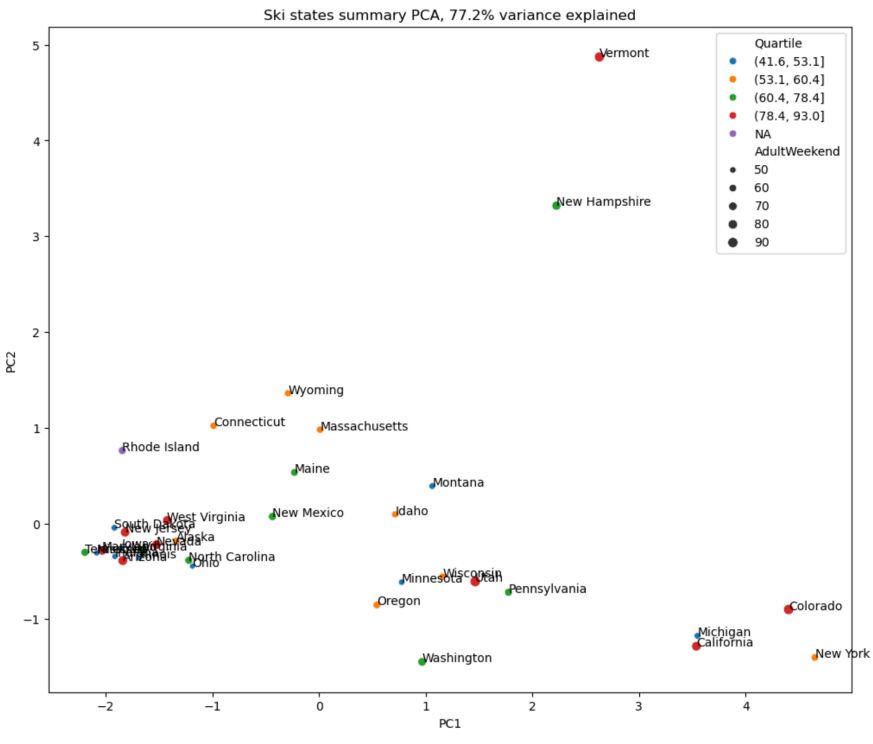
Guided Capstone Project Report
Big Mountain Ski Resort Ticket Pricing

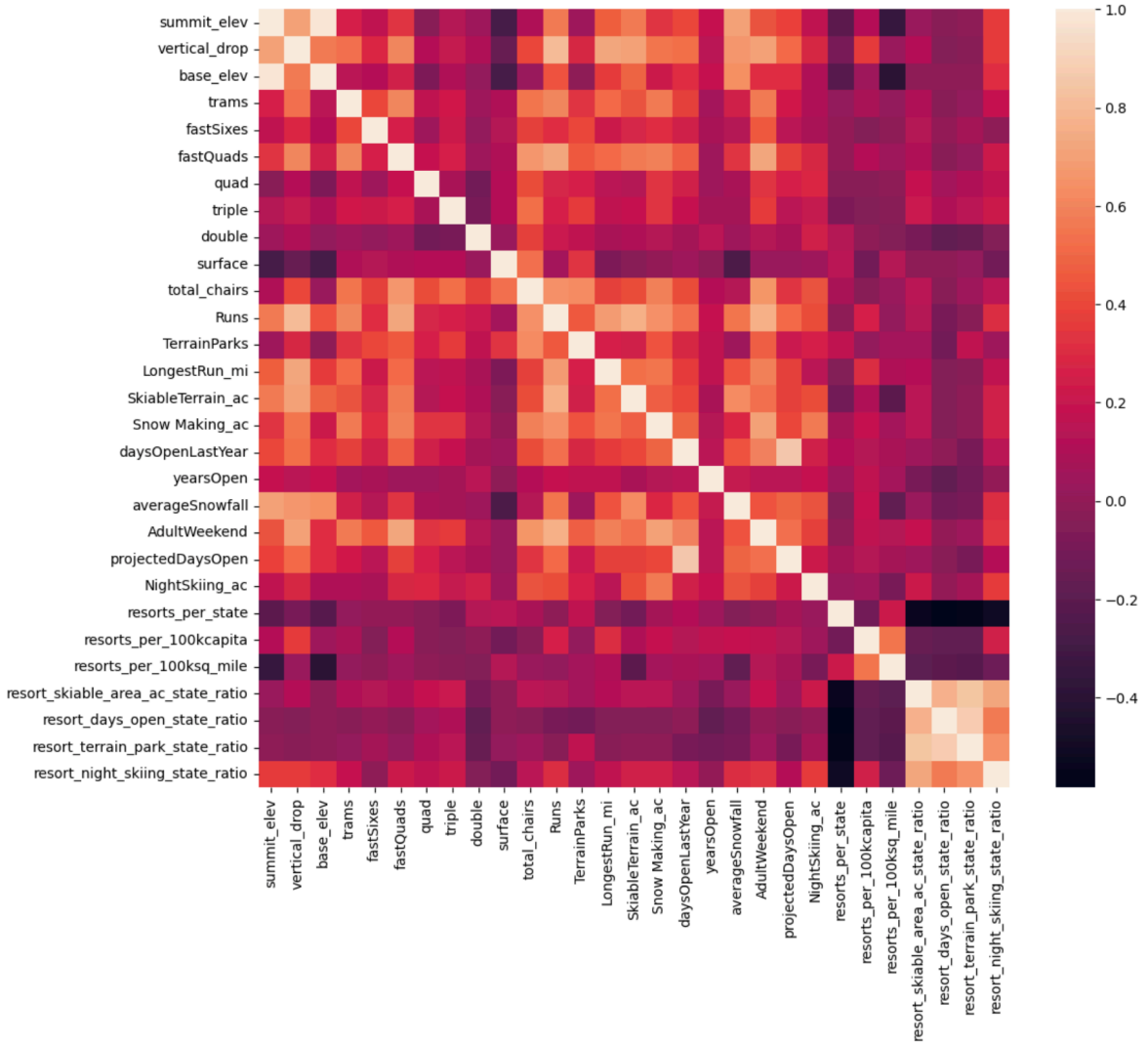
Problem Statement
Big Mountain Resort in Montana currently establishes prices for its ski passes by setting a price above the simple market average, but executives are aware that a more data-driven approach could lead to reduced costs and increased ticket prices, all while remaining competitive within the market. The goal is to determine a price prediction by analyzing data from 330 ski resorts. The new ticket price should cover the cost of recent capital expenditures, which include $1,540,000 spent on a new ski lift, while also providing room for future investments. This price prediction should be provided as soon as possible so that prices can be adapted for the upcoming ski season.

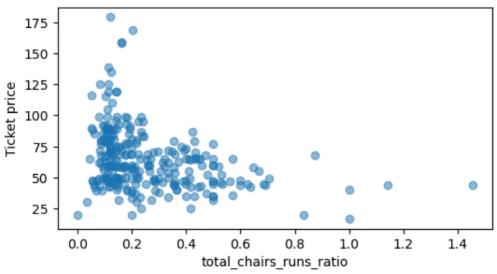
Data Wrangling
Data wrangling began with 330 rows, each representing a different ski resort. The Big Mountain Resort row was determined to be missing no values. The row for 'fast eights' was dropped as there were too many missing values in this column. Weekday prices were also dropped as no resorts in the state of Montana have differing weekend and weekday prices, allowing us to focus solely on weekend pricing. One resort's data stated it had been open for 2019 years and was therefore dropped. All rows with a 'null' value for weekend pricing were also dropped, as this is the key data point we are looking to compare. Some other observations include that many resorts do not offer night skiing, meaning this may not be a useful feature for our analysis. Most resorts have the same value for region and state, but there were five regions listed that were not also states. Therefore, it makes more sense to sort by state when analyzing data rather than region. Silverton Mountain contained an incorrect value for skiable terrain that had to be corrected. Following this initial review of the data, 277 rows remain for analysis and modeling.

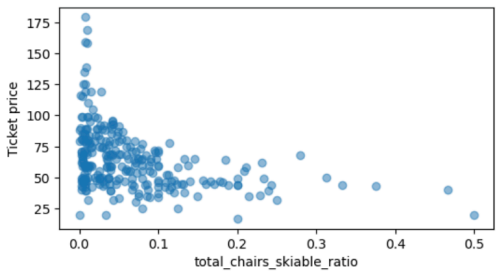
Exploratory Data Analysis
As seen in the chart here, no pattern was found that would suggest a relationship between state and price. This supports building a pricing model that analyzes data from all states together:

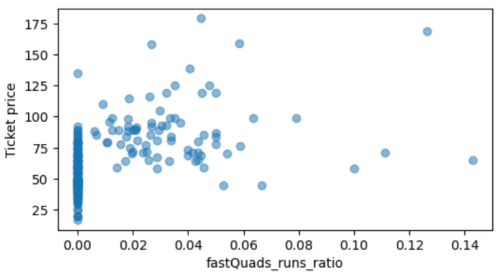


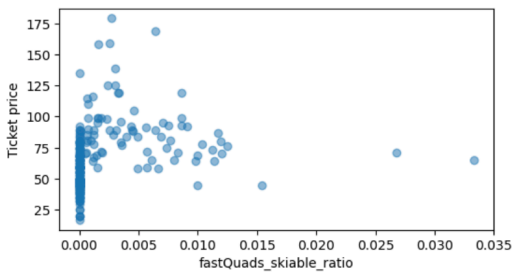
The data points most closely correlated with price are vertical drop, fast quads, runs, and snowmaking, as seen in the heat map and scatterplots below:





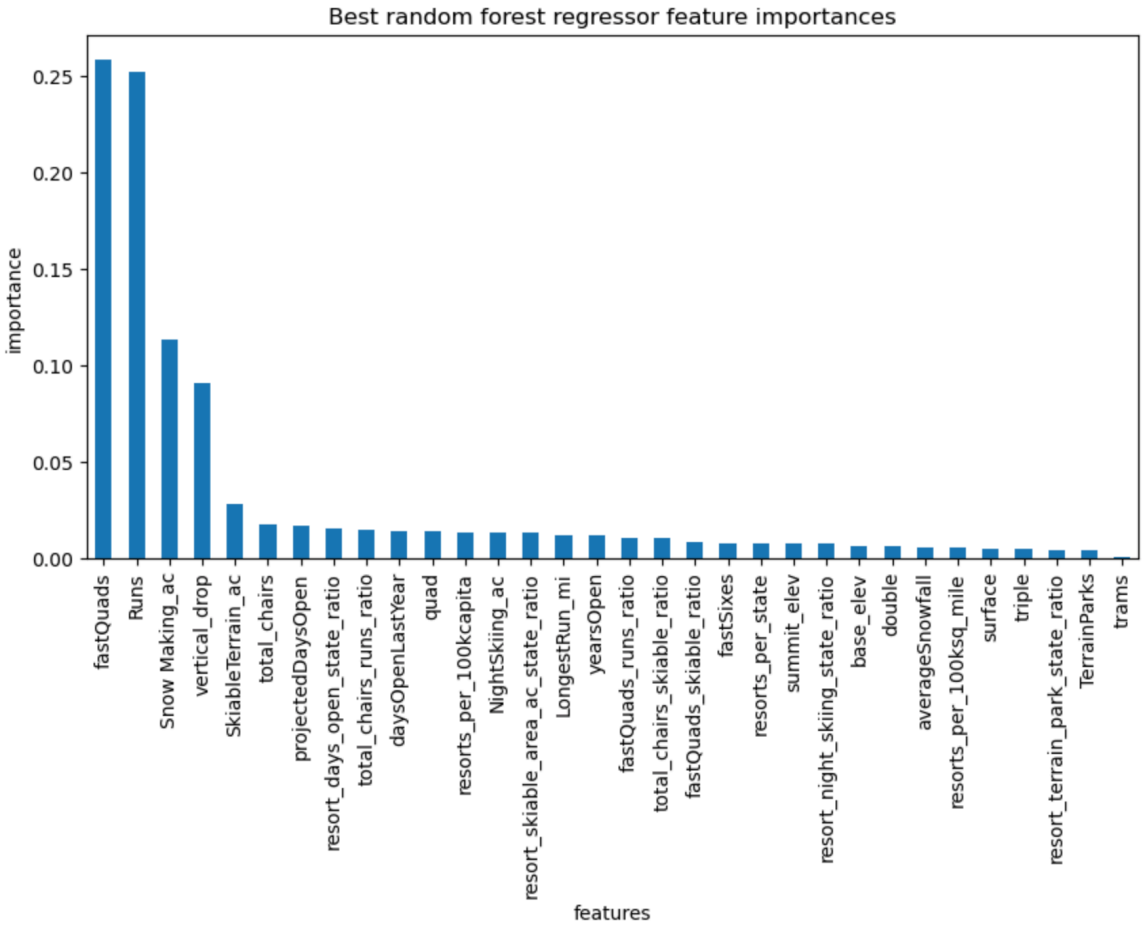


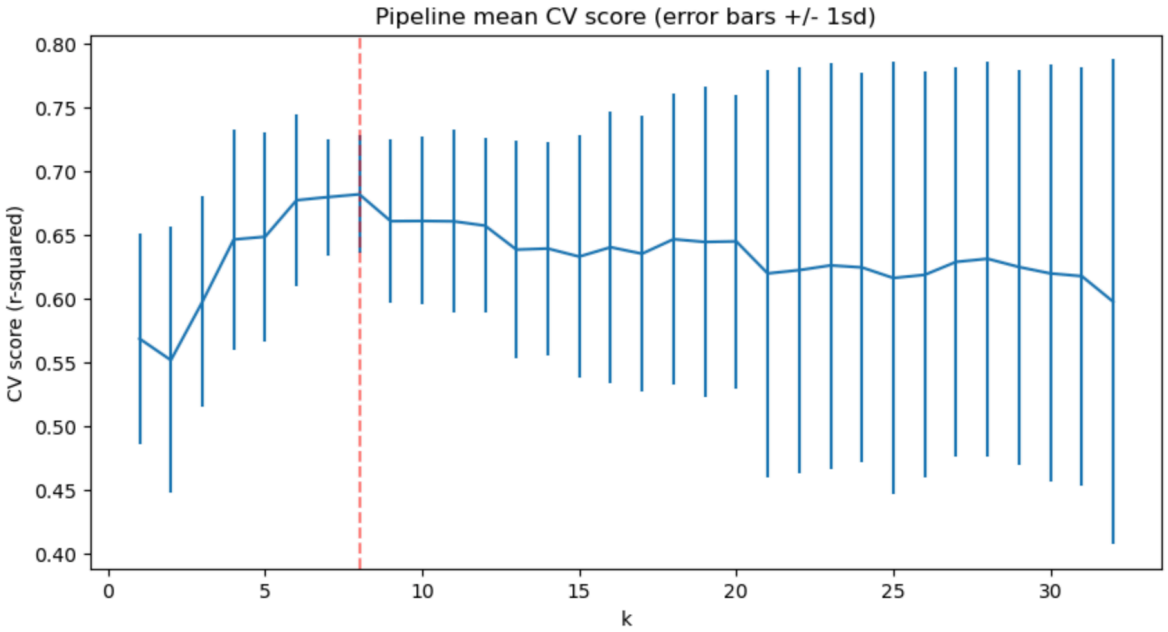




Model Preprocessing with Feature Engineering

Using a 70% training data set a simple average was taken of the Adult Weekend price, returning the value of 63.811. Using mean absolute error, we determined that our price suggestion could be off by as much as $9. By using sklearn to build a pipeline, we are able to use cross-validation to determine that the best k value to use for our model is 8 due to it's low variance and high CV score. Using a random forest regressor, we are able to confirm that the top two features influencing price are fast quads and runs with snow making and vertical drop rounding out the top four features, although not as influential as the first two features.



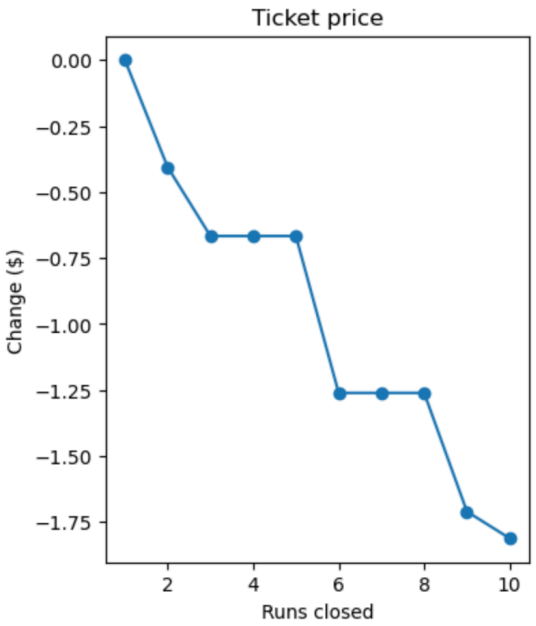


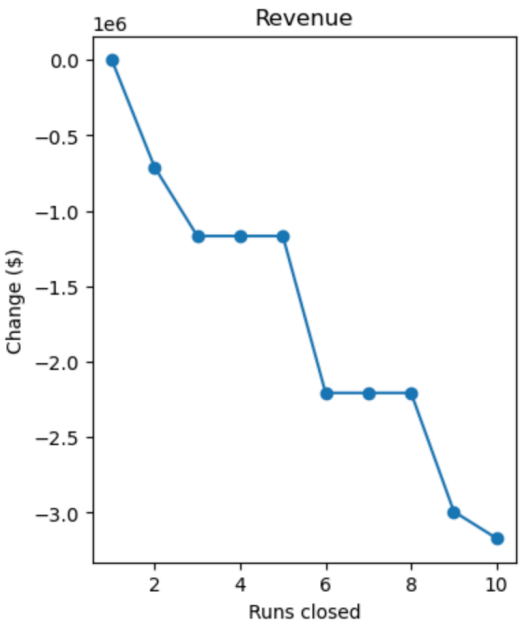
Algorithms used to build the model with evaluation metric

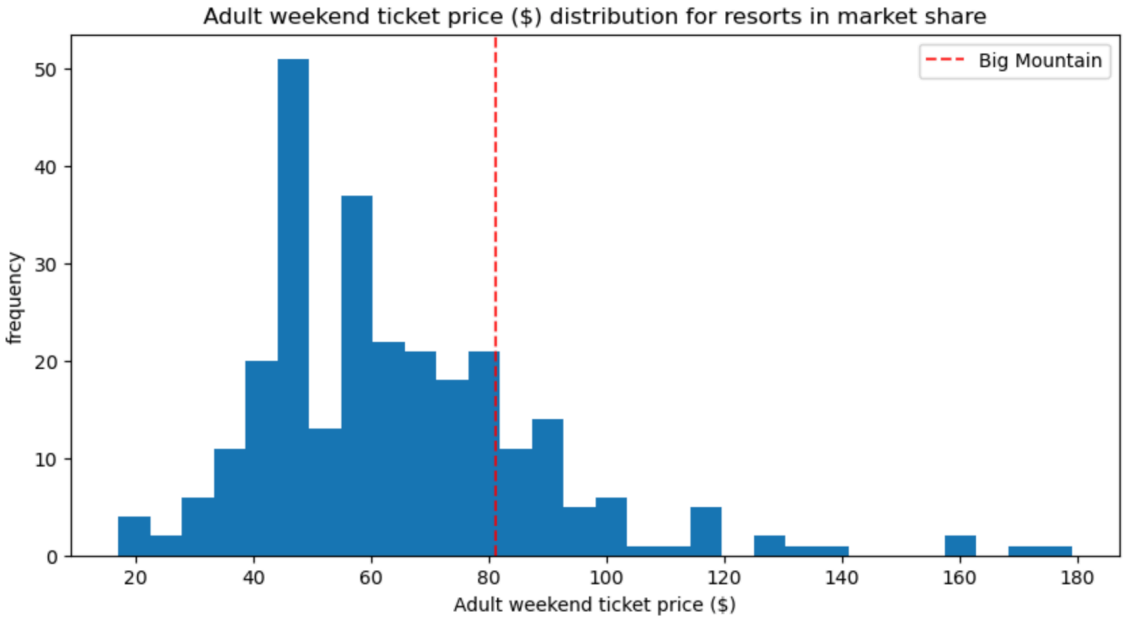
A linear model and random forest model were both modeled and the random forest model has been selected as it has the lower cross-validation mean absolute error of almost $1 and exhibits less variability. The top four features of fast quads, runs, snow making, and vertical drop will be used to determine final price predictions. A data quantity assessment has also been conducted and determined that our sample size is large enough to accurately predict the price.

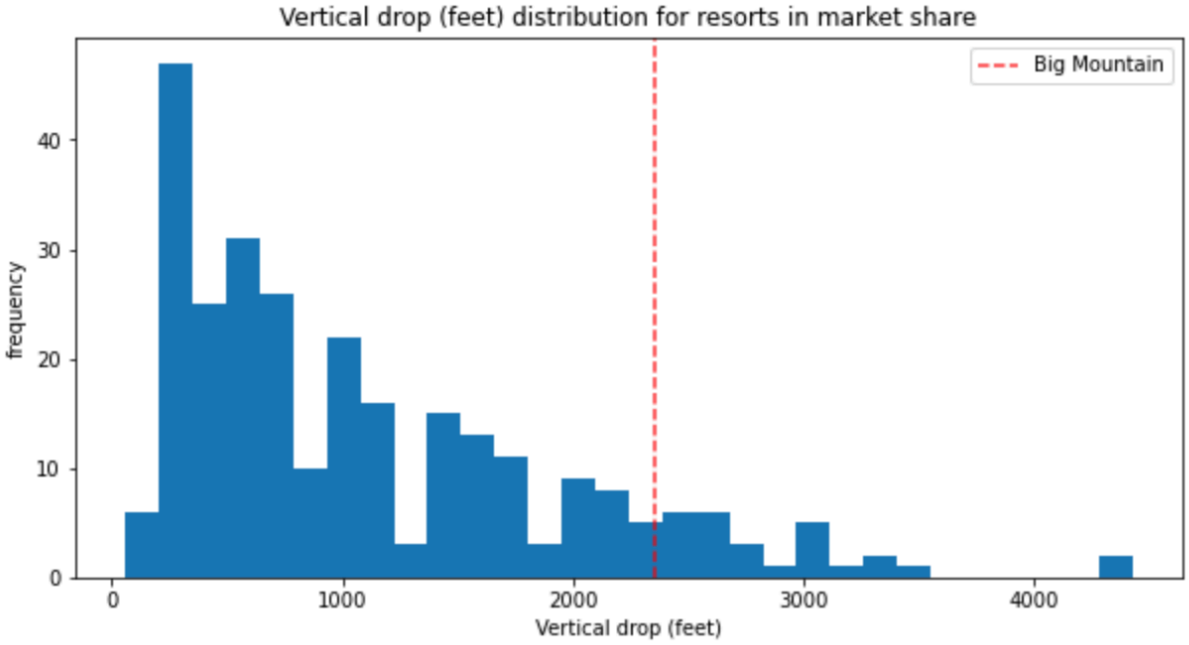
Winning model and scenario modeling
Using the random forest model on the full data set the model suggests a ticket price of $95.87 could be supported in the marketplace. This would be a $14.87 increase over the existing price of $81.

With further modeling, it is recommended that Big Mountain close up to 5 runs while also increasing the vertical drop of the tallest run by 150ft. Decreasing these 5 runs will decrease operating costs without a significant need to lower ticket prices. Based on this modeling, I would recommend closing 5 runs, increasing the vertical drop by 150ft, thus adding a run, and adding a chairlift.









Pricing recommendation
By removing the 5 least used runs, increasing the vertical drop by 150 ft and adding a run, and adding a chair lift, the model supports a ticket price increase of $8.61 projecting an annual revenue increase of $15,065,471, assuming 350,000 annual visitors.

Conclusion
Based on this detailed data analysis and modeling, it is recommended that the ticket price for Big Mountain Resort be increased to $90. Data supports that this price remains competitive with the market and supports future growth if the changes recommended above are made.

Future scope of work
Further data collection regarding the operational costs of each run would allow us to strategically determine which 5 runs to close in order to reduce cost and preserve price. A proposal to generate a similar analysis on an annual basis is recommended to examine Big Mountain Resorts' market position and recommend any future adjustments to feature removal, capital investment, and ticket prices.