How should Big Mountain Resort (1) cut costs across its facilities, (2) improve or add new facilities, and/or (3) select a new ticket price in order to increase this season's profit by at least 5% in comparison to the expected profit at the current price point?

Project Report by Andrew Chung

Context and Project Description

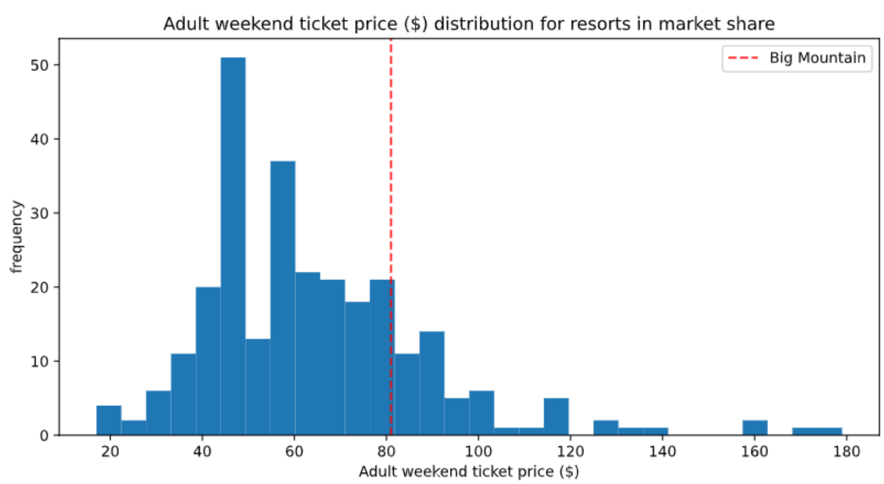
Big Mountain Resort recently installed an additional chair lift that increases their operating costs by $1,540,000 this season. Given this new change, along with the excellent quality of their facilities in general, their pricing strategy has been to charge a premium above the average price. However, the resort does not know how important some facilities are compared to others, and has no concrete data to support their current costs and/or ticket price. As a result, there is a suspicion that they may not be capitalizing on their facilities and maximizing profit.

The objective of this project is to answer the problem statement at the top of this document by identifying (a) the optimal ticket price for Big Mountain Resort given the pricing strategies of other resorts in the same market share, and (b) any potential changes that should be made in terms of cutting down on existing facilities or adding / improving new ones. The data used for this project was taken from a spreadsheet containing relevant features for 330 ski resorts across the U.S. which are considered to be in the same market share.

Recommendation and Key Findings

The following are key findings based on the results of data exploration and fitting an adequate predictive model to the cleaned data:

- Given the pricing strategies of other ski resorts in the same market share, the expected ticket price for Big Mountain Resort is **$95.87**, which is $14.87 greater than the current price of $81. For reference, this is where Big Mountain's current price places with regards to the ticket price of other resorts:



- To cover the operational costs of the **additional chair lift** that was just installed plus the original expected revenue (based on the $81 ticket price and an expected 350,000 visitors per season), Big Mountain should aim to accommodate for at least **298,927 visitors** this season at the increased ticket price of $95.87. (This figure has been constructed *disregarding* the changes suggested by the business, such as closing down the least used runs.)
- To experience an **additional 5% revenue increase** in comparison to the expected revenue for the season at the original price (keeping all costs fixed in both scenarios), Big Mountain should aim to accommodate for at least **310,500 visitors** at the increased ticket price of $95.87. (Again, this figure has been constructed *disregarding* the changes suggested by the business, such as closing down the least used runs.)

The business has also shortlisted the following options for potentially increasing business profit:

1. Permanently closing down up to 10 of the least used runs
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

Out of the options suggested above, the model suggests that **strategies 1 and 2** are worth looking into, while 3 and 4 will most likely yield results that are no better than the first two.

Modeling Results and Analysis

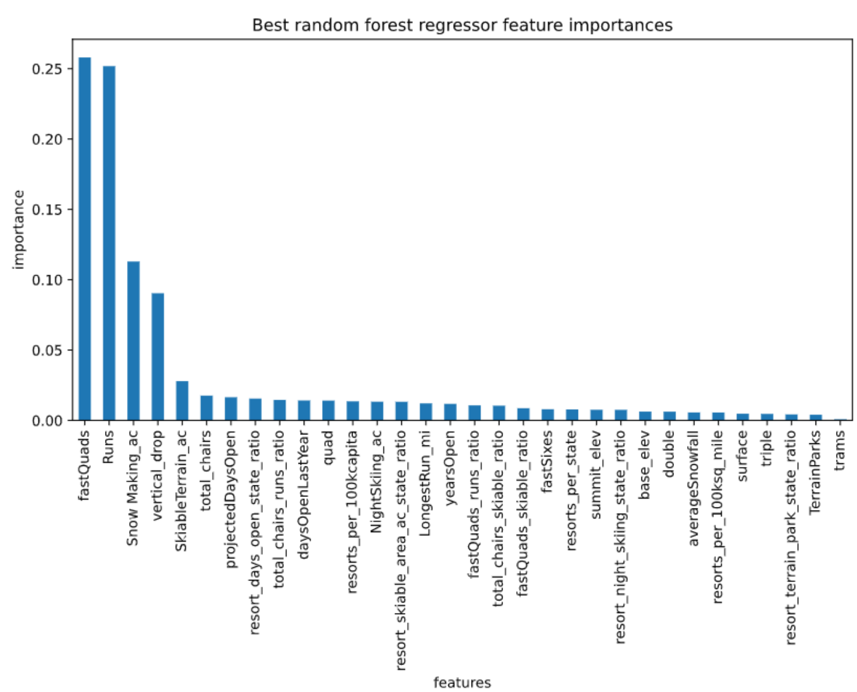
The project focused on predicting weekend ticket prices only for a couple of reasons:

- Ski resorts in Montana, arguably the most relevant subset of resorts in the same market segment, exhibit no difference between weekday and weekend prices (including Big Mountain as well).
- There are less missing values for weekday prices.

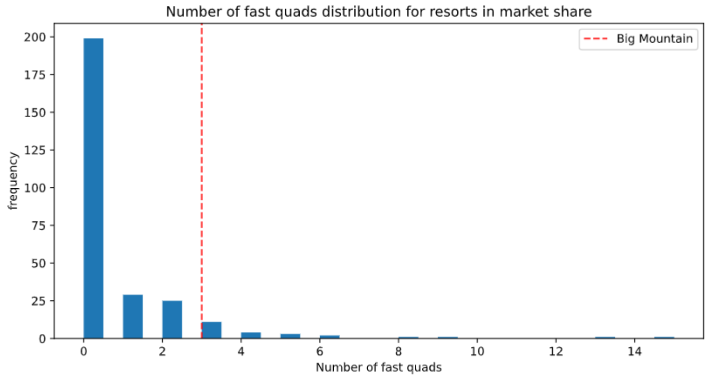
The final model used was fitted equally to all resorts in the dataset which were not dropped during the wrangling process. The reason for this was that there were no commonly observable differences between resorts from different states, even after considering the area and population of each state.

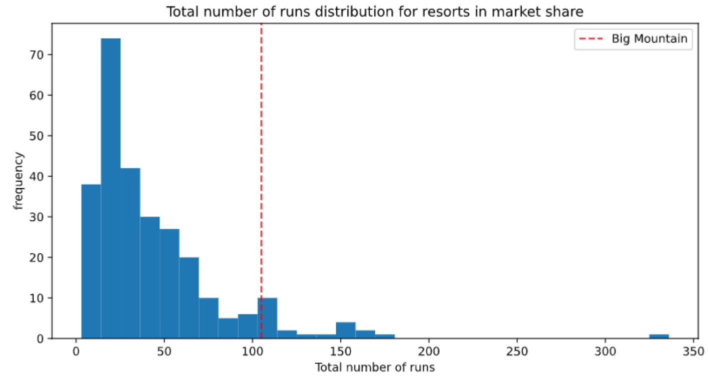
Choice of model was made between (1) a linear regression model and (2) a random forest regression model. While the specifics of implementation are not as important, one should note that the best possible model was chosen — on average, the final random forest regressor was around **$9.54 off** from the actual ticket prices of the resorts it made predictions on, which was over a **50% decrease** from the expected error of $19.14 when simply using the mean of ticket prices as a predictor.

The parameters considered to be most important by the final model were (1) the number of fast quad lifts, (2) the number of runs, (3) acres of snow making, and (4) vertical drop height. The magnitudes of all feature importances are shown in the figure below.

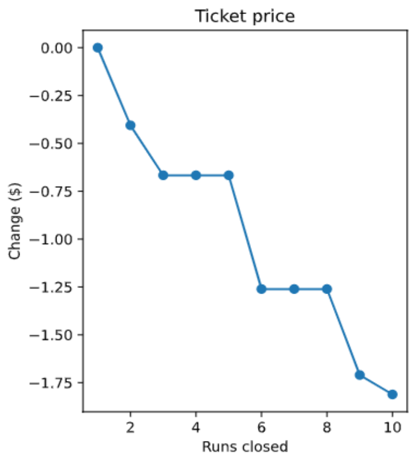


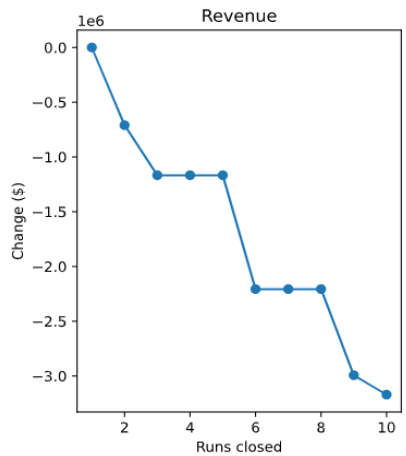
Specifically, it was seen that Big Mountain places near the top of the dataset in terms of both the **number of fast quads** and the **number of runs**, the two most important features by a mile. This can be interpreted to justify the suggested price increase from $81 to $95.14, even though Big Mountain already charges a premium in comparison to other resorts in Montana.





Lastly, one can expect the following changes in ticket price and total revenue for a season when closing down *n* of the least used runs, one of the potential options currently being reviewed by the business:





According to the graphs above, one can see that closing **5 or 8 runs** will likely be the most optimal, since there's no further loss in ticket price compared to closing down 3 or 6 runs, respectively. However, to determine whether this is actually likely to increase profits, further information needs to be provided on the operational cost of each run that is planned to be closed in this scenario.

The second scenario suggested by the business — specifically, that of increasing the vertical drop by 150 feet and adding an additional run and chair lift — will increase support for the ticket price by around **$1.99**, which could amount to **$3,474,638** over the course of an entire season. Again, to validate this approach, further information needs to be disclosed regarding the construction and operational costs of these new facilities.

Scenario 3, which includes an additional two acres of snow making, is predicted to increase the ticket price by no more than scenario 2, making scenario 2 a more attractive option. Lastly, the final option of adding snow making and lengthening the longest run is predicted to cause no difference whatsoever in support for the ticket price, making **scenarios 1 and 2** the most viable options.

If this model is determined to be useful by the business side, further work can be done in coordination with the engineering team to deploy to an application environment (perhaps on the web) in which the UI can allow for various parameters to be tuned and varied. This way, business analysts can easily test various scenarios which may be expected to increase profit.