Big Mountain Resort is a ski resort located in Montana. They charge a premium for their tickets, but they feel as though they are not capitalizing on their facilities. In addition, Big Mountain has recently installed an additional chair lift, increasing operating costs by $1,540,000 for the season. To make up for these new expenses and form a more data driven strategy, our data team was hired to find ways to cut costs and create a more accurate ticket price. Before creating and testing any models, we did a baseline test simply using the average price and finding the r-squared, mean absolute error (MAE), and mean squared error (MSE) with a 70/30 train/test split. While the r-squared values didn't reveal much in terms of how accurate just looking at the mean of some known values is, the MAE showed we would be off by around $19, and the MSE showed a root mean square error of 24.11.

The linear model was used to begin with, being scaled to be within zero mean and unit variance and using mean values to fill any missing data. The MAE showed we would be within $9 of the real price, which is significantly better than our estimate of $19 before. The MSE was also better, with a root mean square error of 12.72. Following that was a random forest model that used 69 trees, used the median for missing values, and didn’t scale the data. The key features of the model were fastQuads, Runs, Snow Making_ac and vertical drop, all consistent with the EDA analysis from before. After performing cross-validation on both models, the MAE was lower on the random forest model by almost $1, and exhibited less variability, making it the ideal model, as it could be tuned to be even more accurate with some more time adjusting the many hyperparameters.

After finalizing training the model by using the whole data set, tests were run using Big Mountain’s features to see the model’s ideal ticket price. Currently, Big Mountain charges $81, which is the highest in the state of Montana. However, the initial run of our model suggests a ticket price of $95.87, which even with a mean average error of $10.39, shows that Big Mountain is under charging by $14.87 based on other resorts in the market. This suggestion to change the ticket price can be supported by comparing Big Mountain's facilities to other resorts, which will show that Big Mountain typically has above average numbers for the features that are closely associated with ticket price based on our model compared to others in the same marketplace (Figures 1-3). Its pricing isn’t even among the most expensive, despite its features’ above average numbers (Figure 4).

With this new information on ticket price, the additional operating costs of $1,540,000 for the new chair lift can more than be covered by an increase in a dollar, assuming 350,000 visitors buying on average 5 day tickets. With such a difference in the suggested model’s pricing, even just a couple of dollars more would be well within reason for visitors to pay and still keep coming, thus maintaining the amount of annual visitors. We were also given several scenarios to run to test their impact on ticket pricing and revenue. The results all used an annual visitor count of 350,000 and 5 day tickets per on average:

1. **Closing down up to 10 of the least used runs.** By closing down 1 run, the ticket price and therefore revenue is unaffected. Removing any more would hurt ticket prices by almost 50 cents, but if 3 runs are needed to be shut down, shutting down 5 instead would not change the price. Would only recommend closing 1 or 5 runs.
2. **Adding a run, increasing the vertical drop by 150 feet, and installing an additional chair lift, without increasing snow making coverage.** This scenario increases support for ticket price by $1.99. Over the season, this could be expected to amount to $3,474,638. This seems like a great addition for the future and we would recommend it.
3. **Same as number 2, but adding 2 acres of snow making cover.** This scenario produced the same results as the second one, meaning there is no need to also increase snowmaking coverage, thus this scenario is not recommended over scenario 2.
4. **Increase the longest run by 0.2 mile to boast 3.5 miles length, requiring an additional snow making coverage of 4 acres.** No increase in price or revenue was found with this change, which makes sense as longest run did not appear among the top features for the random forest model. This scenario is not recommended.

Figure 1

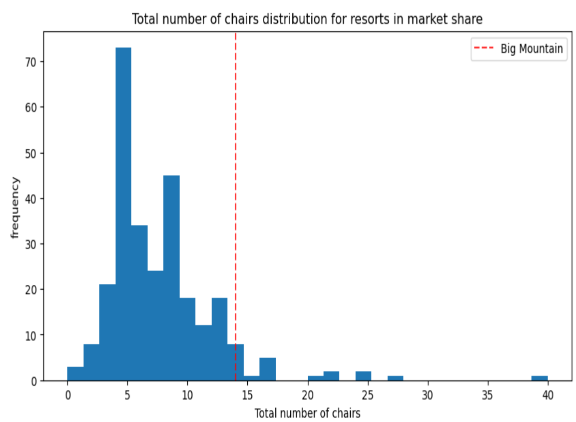

Figure 2

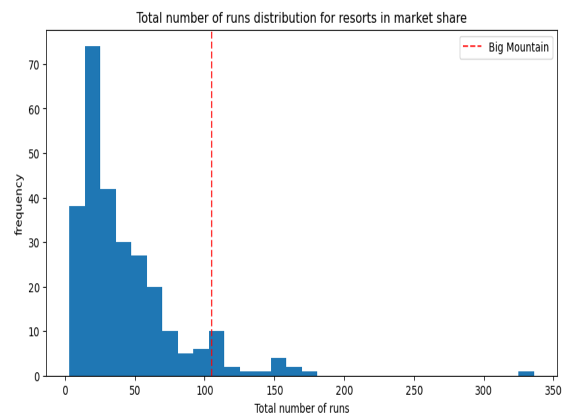

Figure 3

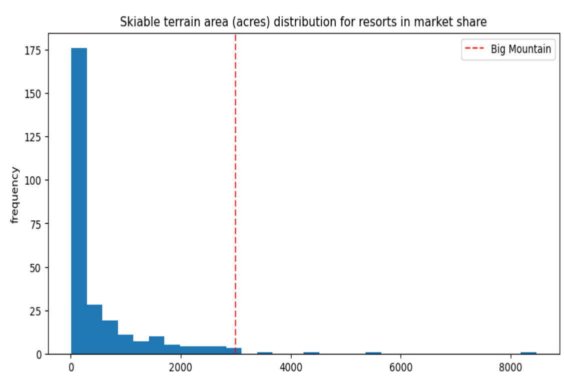

Figure 4